Original Article

MEDICINE PALLIATIVE CARE

DOI: 10.47582/jompac.1854078

J Med Palliat Care. 2026;7(1):101-107

The effect of classical Turkish music on pain and anxiety during thyroid fine-needle aspiration biopsy

Vildan Kölükçü*[1], Yaşar Birişik[2], İfakat İrem Biçer[3], Merve Çatak[4]

[1]1Department of Anesthesiology and Reanimation, Faculty of Medicine, Tokat Gaziosmanpaşa University, Tokat, Turkiye

[2]Department of Radiology, Faculty of Medicine, Tokat Gaziosmanpaşa University, Tokat, Turkiye

[3]Department of Internal Medicine, Kayseri City Training and Research Hospital, Kayseri, Turkiye

[4]Division of Endocrinology and Metabolism, Department of Internal Medicine, Faculty of Medicine, Tokat Gaziosmanpaşa University, Tokat, Turkiye

Cite this article as: Kölükçü V, Birişik Y, Biçer İİ, Çatak M. The effect of classical Turkish music on pain and anxiety during thyroid fine-needle aspiration biopsy. *J Med Palliat Care*. 2026;7(1):101-107.

Received: 01.01.2026 ◆ **Accepted**: 02.02.2026 ◆ **Published**: 20.02.2026

ABSTRACT

Aims: This study aimed to investigate the effect of classical Turkish music on pain and anxiety levels in patients undergoing thyroid fine-needle aspiration biopsy (FNAB).

Methods: In this prospective study, a total of 84 patients who underwent thyroid FNAB were enrolled. Participants were assigned to two groups. Patients in group 1 served as the control group, while those in group 2 listened to classical Turkish music during the procedure. Sociodemographic characteristics, vital signs, Visual Analog Scale (VAS) scores, and State Anxiety Inventory (SAI) scores were recorded.

Results: No significant differences were observed between the two groups in terms of marital status, educational level, employment status, sex and age ($p>0.05$). Additionally, pre- and post-procedural measurements of heart rate, oxygen saturation, diastolic blood pressure and , systolic blood pressure were comparable between the groups ($p>0.05$). However, post-procedural SAI and VAS were significantly lower in group 2, with mean values of 35.84±5.04 and 3.18±0.73, respectively, compared with group 1 ($p=0.004$ and $p<0.001$, respectively).

Conclusion: The findings of this study indicate that listening to classical Turkish music during thyroid FNAB effectively reduces both pain perception and anxiety levels.

Keywords: Thyroid biopsy, classical Turkish music, pain, anxiety

INTRODUCTION

Thyroid cancer is the most common endocrine malignancy, and epidemiological data indicate that its incidence has increased by 300% over the past three decades. The estimated 5-year survival rate of thyroid cancer is approximately 98.1%.[1] Patients most commonly present with a palpable thyroid nodule, and ultrasonography is recommended as the first-line imaging modality for the evaluation of thyroid nodules.[2] Ultrasound-guided FNAB is a well-established, widely accepted, and reliable diagnostic method for thyroid malignancies.[2,3] Reported overall complication rates associated with this procedure are below 1%.[4] The most frequently encountered complications include hematoma formation, edema, infection, and pain.[3,4]

Pain and anxiety are commonly experienced by patients undergoing ultrasound-guided FNAB of thyroid nodules. More than half of patients report mild to severe pain during or after the procedure.[5] Consequently, considerable attention has been directed toward identifying strategies that may help alleviate discomfort associated with this invasive intervention. Among these approaches, music therapy has gained increasing attention in recent years. Music has been shown to promote relaxation, evoke positive emotional responses, and serve as a cognitive distraction, thereby reducing the perception of pain. Numerous clinical studies have demonstrated that music therapy can enhance patient comfort across a variety of medical procedures.[6]

In this prospective clinical study, we aimed to evaluate the effect of classical Turkish music on pain and anxiety status in cases undergoing thyroid FNAB.

METHODS

This prospective study included adult patients (≥18 years of age) who underwent thyroid FNAB at Tokat Gaziosmanpaşa University between June and December 2025.

The study was approved by the Clinical Researches Ethics Committee of Kayseri City Training and Research Hospital (Date: 12.05.2025, Decision No: 92). Written informed

***Corresponding Author:** Vildan Kölükçü, vildankolukcu@gmail.com

This work is licensed under a Creative Commons Attribution 4.0 International License.

consent was obtained from all participants, and this study was conducted in accordance with the principles of the Declaration of Helsinki as defined by the World Medical Association.

Patients were divided into two groups based on an even-odd file numbering system. The numbering was assigned automatically by the hospital's computer system. This method was used for practical convenience. Patients in the control group (group 1) underwent the biopsy procedure under standard conditions, whereas those in the intervention group (group 2) were exposed to classical Turkish music during the procedure. This study has a quasi-randomized research design that does not include allocation concealment.

In group 1, thyroid FNAB was performed according to routine clinical practice.

In group 2, patients listened to instrumental classical Turkish music in the Zirgüle maqam, characterized by a slow and soothing rhythm of approximately 60–80 beats per minute. The sound level was 50–60 dB and did not interfere with communication. Music playback began upon entry into the procedure room and continued until completion of the intervention. The music was played directly in the procedure room without the use of headphones, with appropriate volume adjustment to ensure patient comfort.[7,8] However, due to technical limitations, active control mechanisms such as using headphones with silence/white noise to prevent sound leakage/contamination were not provided.

All participants received detailed written information regarding the study protocol, and written and verbal informed consent was obtained prior to enrollment.

Ultrasound examinations were performed using of US systems equipped with a linear, high-frequency probe (range 3-14 MHz): an HS50 (Samsung Medison Co.Ltd., Republic Of Korea). All ultrasound examinations and thyroid FNAB were performed by experienced radiologists with 13 years of clinical experience in thyroid ultrasound examinations. For the this procedure, 27-gauge needles (40 mm length,0,4 mm thickness, TSK Tıp Kimsan; Create Medic, İstanbul, Turkiye) were used, and all patients were checked using direct smears. Biopsy procedures were performed on a single nodule. However, the size or depth of the nodule was not calculated.

Prior to the procedure, the sociodemographic characteristics of all participants were recorded, and anxiety levels were assessed using the State Anxiety Inventory (SAI). In addition, immediately before the thyroid FNAB, physiological parameters, including oxygen saturation, heart rate, and systolic and diastolic blood pressure, were measured upon admission to the procedure room.[8]

Following completion of the biopsy, all participants were asked to complete the SAI once again. Pain intensity was subsequently evaluated using the Visual Analog Scale (VAS).[3] These two assessments were performed immediately after the procedure. Post-procedural measurements of oxygen saturation, heart rate, and systolic and diastolic blood pressure were also obtained for all patients.[8]

The SAI is a component of the State–Trait Anxiety Inventory. The State–Trait Anxiety Inventory was originally developed by Spielberger and colleagues in 1970. The Turkish adaptation and validation of the scale were subsequently conducted by Öner and Le Compte. The instrument consists of two distinct subscales, each containing 20 items rated on a 4-point Likert scale, designed to assess state and trait anxiety levels. In the present study, the SAI was utilized for anxiety assessment. The scale requires individuals to report how they feel at a given moment and under specific circumstances reflecting their current emotional state. Total scores obtained from the scale range between 20 and 80. Higher scores indicate greater levels of anxiety.[8,9]

Pain intensity was evaluated using the VAS. The VAS is a numerical scale ranging from 0 to 10, where 0 represents no pain and 10 corresponds to the most severe pain imaginable. Increasing numerical values reflect greater pain intensity. Following the procedure, participants were asked to indicate their perceived pain intensity using the scale.[9,10] No patient received either local anesthesia or systemic analgesia.

Patients with a prior history of thyroid FNAB, as well as those with auditory, psychiatric, or neurological disorders, were excluded from the study.

All procedures were carried out by the same healthcare professionals.

Statistical Analysis

Descriptive statistics for continuous variables are presented as mean±standard deviation (SD), while categorical variables are expressed as number and percentage. Normality of continuous variables was assessed using visual inspection methods.

Comparisons between two independent groups were performed using the independent samples *t*-test for normally distributed continuous variables. Within-group pre–post comparisons were conducted using paired samples t-tests. Categorical variables were compared using the Chi-square test as appropriate.

The primary endpoint of the study was defined as the change in SAI score from pre- to post-procedure. Between-group differences in post-procedural SAI scores were additionally evaluated using analysis of covariance (ANCOVA), with baseline SAI included as a covariate. Secondary outcomes included post-procedural SAI and VAS pain scores.

Effect sizes for between-group comparisons were calculated using Cohen's d, and corresponding 95% confidence intervals were reported to complement p-values.

To explore factors associated with post-procedural SAI and VAS scores, multiple linear regression analyses were performed. Independent variables included age, body-mass index, procedure duration, sex, educational status, employment status, and marital status. Multicollinearity was assessed using variance inflation factors.

Model assumptions were evaluated prior to interpretation. Normality of residuals was assessed by visual inspection of histograms and normal probability (Q–Q) plots. Homoscedasticity was examined using scatter plots of standardized residuals versus standardized predicted

values. Potential influential observations were assessed using standardized residuals and Cook's distance. No major violations of regression assumptions were observed.

A p-value <0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA).

G*Power (Ver. 3.1.9.7, University of Dusseldorf, Germany) software was used to determine the statistical power of the study and calculate the required minimum sample size.

It was determined that the study hypothesis could be tested using the before&after SAI scores as the primary variable, with a calculated effect size (0.90), α error (0.05), and statistical power (1–β) of 0.90, requiring a minimum sample size of 54 subjects.[11] In the power analysis, the mean and standard deviation values were estimated from the reported median and interquartile range.

RESULTS

A total of 84 patients were included in the study, of whom 29 (34.5%) were male. The mean age of the participants was 53.87±9.19 years, and no statistically significant difference was observed between the groups with respect to age distribution (p>0.05). The mean body-mass index (BMI) was 24.55±3.16 kg/m^2 in group 1 and 24.98±2.82 kg/m^2 in group 2, with no significant difference between the groups (p>0.05). Likewise, no statistically significant differences were observed between the groups in terms of educational status, sex, or marital status, or employment status, (p>0.05) (Table 1).

The mean duration of the procedure was 10.27±2.84 minutes, and no significant difference was found between the groups (p>0.05). Pre-procedural measurements of systolic arterial pressure, oxygen saturation, heart rate, and diastolic blood pressure were comparable between the two groups. Similarly, post-procedural assessments of systolic arterial pressure, oxygen saturation, heart rate, and diastolic blood pressure showed no statistically significant differences between the groups (p>0.05) (Table 2). A detailed examination of our results revealed that baseline SpO_2 values were relatively low.

Table 1. Sociodemographic characteristics and procedure duration of the patients

		Group1 (n=42)	Group2 (n=42)	Test-1
Age (years)		54.48±9.70	53.26±8.72	0.548
BMI (kg/m^2)		24.55±3.16	24.98±2.82	0.514
Duration of procedure		10.43±3.01	10.12±2.68	0.620
		n (%)	n (%)	Test-2
Gender	Female	27 (64.3)	28 (66.7)	0.999
	Male	15 (35.7)	14 (33.3)	
Educational status	Primary/ secondary school	23 (54.8)	24 (57.1)	0.999
	Highschool and above	19 (45.2)	18 (42.9)	
Employment status	Not working	29 (69.0)	30 (71.4)	0.999
	Employed	13 (31.0)	12 (28.6)	
Marital status	Single	19 (45.2)	20 (47.6)	0.999
	Married	23 (54.8)	22 (52.4)	

Data are expressed as n (%) or mean±standard deviation (SD).
Test-1: Independent samples t-test
Test-2: Chi-square test
Categorical variables (sex, educational status, marital status, and employment status) were reanalyzed using Chi-square as appropriate. Independent samples t-tests were reserved exclusively for continuous variables. BMI: Body-mass index

Although our patients were not using medications that could affect anxiety/pain, such as anxiolytics, antidepressants, or beta-blockers, we believe these results are related to the geographical conditions where the procedure was performed and the demographic characteristics of the community.

Prior to the procedure, the mean SAI scores were 42.69±6.85 in group 1 and 42.71±6.10 in group 2, with no statistically significant difference between the groups (p>0.05). Following the procedure, a reduction in SAI scores was observed in both groups. However, the post-procedural mean SAI score was significantly lower in group 2, with a value of 35.84±5.04, compared with group 1 (p=0.004). The magnitude of change in SAI scores also differed significantly between the groups. While the mean reduction in SAI score was 3.02±2.77 in group 1, a greater decrease of 6.87±1.65 was observed in group

Table 2. Pre- and post-procedural vital signs

	Group		Test
	Group 1 (n=42)	Group 2 (n=42)	
Pre-procedural systolic arterial pressure (mmHg)	119.17±16.78	120.36±16.13	0.741
Post-procedural systolic arterial pressure (mmHg)	123.33±16.59	126.07±15.83	0.441
Pre-procedural diastolic arterial pressure (mmHg)	67.74±7.34	68.21±7.72	0.773
Post-procedural diastolic arterial pressure (mmHg)	69.4±7	69.64±6.84	0.875
Pre-procedural heart rate (bpm)	81.79±7.39	82.14±7.58	0.828
Post-procedural heart rate (bpm)	83.33±5.91	84.05±5.32	0.562
Pre-procedural O_2 saturation	93.81±2.36	94.29±2.02	0.323
Post-procedural O_2 saturation	94.17±2.12	94.52±1.77	0.404
Pre-procedural respiratory rate (breaths/min)	19.57±2.15	19.79±2.11	0.647
Post-procedural respiratory rate (breaths/min)	19.83±2.33	19.93±2.20	0.848

Data are expressed as n (%) or mean±standard deviation (SD). Test: Independent samples t-test

2 (p<0.001). In terms of pain assessment, the mean VAS scores were 5.14±1.03 in group 1 and 3.18±0.73 in group 2. Statistical analysis revealed that pain intensity was significantly higher in group 1 compared with group 2 (p<0.001) (Table 3).

Sociodemographic characteristics and procedure duration were not identified as independent predictors of VAS scores. In the multiple linear regression analysis conducted to evaluate factors associated with VAS scores, the model did not reach statistical significance (F=0.709; p=0.665). The explanatory power of the model was low (R^2=0.064; adjusted R^2=0.027), indicating that the included variables accounted for approximately 6% of the total variance in pain scores (Table 4). Similarly, the regression model constructed to predict post-procedural SAI scores was not statistically significant (F=0.952; p=0.473). The model demonstrated limited explanatory capacity (R^2=0.085; adjusted R^2=0.004), suggesting that post-procedural anxiety levels were largely independent of the sociodemographic variables and procedural duration evaluated in this study (Table 5).

After adjustment for baseline anxiety levels, analysis of covariance demonstrated a significant group effect on post-procedural SAI scores. Patients in the music group had significantly lower post-procedural anxiety compared with the control group (F=75.04, p<0.001), with a very large effect size (partial η^2=0.494). Baseline SAI score was also a strong predictor of post-procedural anxiety (F=567.56, p<0.001, partial η^2=0.881) (Table 6).

DISCUSSION

Patients undergoing medical interventions often experience anxiety and fear, which may subsequently influence physiological parameters such as heart rate, blood pressure, respiratory rate, pain perception, and circulating stress hormone levels.[8] Thyroid FNAB is a commonly performed invasive procedure in endocrine practice. In the United States alone, more than 600,000 thyroid FNAB procedures are performed annually, and this number continues to increase at an estimated rate of 16% per year.[12,13] A substantial proportion of patients report anxiety prior to the procedure and experience varying degrees of pain afterward. Previous studies have demonstrated that nearly three-quarters of patients undergoing invasive interventions experience anxiety, while approximately half report moderate to severe pain.[14]

Music has been used as a therapeutic modality since ancient times to influence human well-being. Historical observations from the mid-18th century suggest that continuous and rhythmically structured sounds can exert calming effects on patients. During the first half of the twentieth century, music began to be incorporated into clinical settings as a non-pharmacological therapeutic approach.[7] The mechanisms through which music exerts its effects on pain and anxiety are complex; however, it is widely accepted that music serves as a form of cognitive distraction, allowing individuals to divert attention away from discomfort and reducing the

Table 3. Pre- and post-procedural anxiety and pain scores

	Group		Test	Cohen's d (95% CI)
	Group 1 (n=42)	Group 2 (n=42)		
Pre-procedural SAI score	42.69±6.85	42.71±6.1	0.989	
Post-procedural SAI score	39.64±6.16	35.84±5.04	0.004*	0.68 (0.22-1.12)
Test 2	<0.001*	<0.001*		
Mean change in SAI score before and after (ΔSAI)	3.02±2.77	6.87±1.65	<0.001*	1.67 (1.15-2.17)
VAS	5.14±1.03	3.18±0.73	<0.001*	2.18 (1.62-2.73)

Data are expressed as n (%) or mean±standard deviation (SD). Test: Independent samples t-test. Effect sizes (Cohen's d) and corresponding 95% confidence intervals were added for all relevant between-group comparisons to complement p-values and enhance clinical interpretability. SAI: State Anxiety Inventory, VAS: Visual Analog Scale

Table 4. Multiple Lineer regression analyses between the VAS and other variables

Model	B	Std. error	β (Beta)	t	p	Confidence interval (95%)		VIF
						Lower limit	Higher limit	
Constant	6.508	1.589		4.096	<0,001	3.341	9.675	
Age	0.001	0.017	0.009	0.077	0.938	-0.034	0.036	1.124
BMI	-0.106	0.055	-0.233	-1.923	0.058	-0.216	0.004	1.130
Duration of procedure	0.021	0.055	0.046	0.386	0.700	-0.089	0.131	1.072
Gender	0.404	0.945	0.145	0.428	0.670	-1.479	2.287	8.814
Educational status	0.161	0.697	0.060	0.231	0.818	-1.229	1.551	5.247
Employment status	-0.624	0.836	-0.217	-0.746	0.458	-2.290	1.043	6.481
Marital status	0.059	0.536	0.022	0.109	0.913	-1.010	1.127	3.165
R=0.254	R^2=0.064		Adj. R^2=0.027			F:0.709; p=0.665		

Dependent variable: VAS. Independent variables: Age, BMI, duration of procedure, sex, educational status, employment status, marital status. p: One-Way Analysis of Variance (ANOVA). The regression model was not statistically significant (F=0.709; p=0.665). The reference categories were defined as follows: Sex: Female; Educational status: Primary/secondary school; Employment status: Not working; Marital status: Single. VAS: Visual Analog Scale, BMI: Body-mass index

Table 5. Multiple results of lineer regression analyses between the post-procedural SAI score and other variables

Model	B	Std. error	β (Beta)	t	p	Confidence interval (95%)		VIF
						Lower limit	Higher limit	
Constant	40.14	7.024		5.715	<0.001	26.138	54.142	
Age	0.032	0.077	0.049	0.409	0.684	-0.123	0.186	1.124
BMI	-0.196	0.243	-0.096	-0.803	0.424	-0.681	0.29	1.13
Duration of procedure	0.035	0.244	0.017	0.144	0.886	-0.451	0.521	1.072
Gender	-2.398	4.177	-0.192	-0.574	0.568	-10.724	5.928	8.814
Educational status	-1.15	3.083	-0.096	-0.373	0.710	-7.295	4.995	5.247
Employment status	-1.145	3.696	-0.089	-0.31	0.758	-8.512	6.222	6.481
Marital status	4.062	2.37	0.344	1.714	0.091	-0.663	8.787	3.165
R=0.291	R^2=0.085		Adj. R^2=0.004		F:0.952; p=0.473			

p: One-Way Analysis of Variance (ANOVA). The regression model was not statistically significant. (F=0.952; p=0.473). The reference categories were defined as follows: Sex: Female; Educational status: Primary/secondary school; Employment status: Not working; Marital status: Single. Dependent variable: Post-procedural SAI score. Independent variables: Age, BMI, duration of procedure, sex, educational status, employment status, marital status. SAI: State Anxiety Inventory, BMI: Body-mass index

Table 6. ANCOVA results for post-procedural State Anxiety Inventory (SAI) scores

Source	Type III sum of squares	Mean square	F	p	Partial η^2
Pre-procedural SAI score	2198.44	2198.44	567.56	<0.001*	0.881
Group	290.68	290.68	75.04	<0.001*	0.494
Error	298.26	3.87	–	–	–

Dependent variable: Post-procedural SAI score. Covariate: Pre-procedural (baseline) SAI score. Fixed factor: Group (music vs control). SAI: State Anxiety Inventory

emotional burden associated with pain.[14,15] Consequently, music therapy has been widely recommended to minimize analgesic requirements and alleviate anxiety in various clinical contexts.[14] It has been increasingly implemented in invasive procedures, oncology settings, and intensive care units to enhance patient comfort.[8] Classical Turkish music, characterized by its slow tempo and soothing instrumental structure, is known to exert calming psychological effects.[7,8] This musical tradition is widely appreciated across Anatolia and has been associated with relaxation and emotional regulation. In the present study, the intervention focused specifically on classical Turkish music composed in the Zirgüle maqam, which is traditionally associated with tranquil and soothing auditory experiences.[7]

Current evidence regarding the effects of music on pain and anxiety during thyroid FNAB remains limited. In a prospective randomized controlled study conducted by Barlas et al.,[3] music listening was shown to significantly reduce SAI scores; however, no statistically significant effect on pain intensity was observed. In contrast, another study involving 91 patients reported a significant reduction in pain levels among individuals exposed to music during the procedure.[11] In our prospective study, we observed that classical Turkish music had a positive effect on both pain and anxiety levels in thyroid FNAB.

The number of studies specifically examining the effects of classical Turkish music on pain and anxiety remains limited in the literature. In a study conducted by Kılıc et al.,[16] the authors reported that exposure to classical Turkish music in the emergency department resulted in a significant reduction in both anxiety and pain levels, while also improving patient satisfaction. Similarly, Toker et al.[17] demonstrated that listening to classical Turkish music was associated with decreased postoperative anxiety and pain levels in women undergoing cesarean delivery. In a different clinical context, Ozdemir et al.[8] evaluated patients undergoing bone marrow aspiration and biopsy and observed that, although music listening was associated with reduced pain intensity, anxiety levels paradoxically increased. Ciğerci et al.[18] reported that classical Turkish music reduced pain perception and analgesic requirements in patients undergoing coronary artery surgery, while also significantly improving oxygen saturation levels in individuals monitored in the intensive care unit. Likewise, Sarıtaş et al.[7] found that among patients admitted to coronary intensive care units following myocardial infarction, exposure to classical Turkish music led to reductions in pain scores, analgesic consumption, heart rate, and blood pressure, along with an increase in oxygen saturation levels. Furthermore, Zengin et al.[19] demonstrated that listening to classical Turkish music during port catheter placement was associated with decreased stress hormone levels, reduced pain and anxiety, and attenuation of physiological responses such as elevations in blood pressure, heart rate, and respiratory rate. In another study, Ucan et al.[20] reported that although classical Turkish music did not significantly affect blood pressure, heart rate, or oxygen saturation during upper gastrointestinal endoscopy, it markedly enhanced patient satisfaction. Additionally, Orak et al.[21] showed that exposure to classical Turkish music during oocyte retrieval procedures in infertile patients significantly reduced pain perception and oxidative stress levels.

Patients who are exposed to invasive medical procedures frequently experience elevated levels of anxiety. This

psychological response is often accompanied by physiological changes, including alterations in stress hormone levels, blood pressure, heart rate, respiratory rate, and pain perception. For this reason, various non-pharmacological approaches, most notably music listening, have long been incorporated into medical practice as supportive interventions to reduce procedural distress. Thyroid FNAB is among the most commonly performed invasive procedures in radiology units. In the present study, we demonstrated that listening to classical Turkish music during thyroid FNAB has a beneficial effect on both pain perception and anxiety levels. There is limited evidence in the literature regarding this topic. Although no statistically significant changes were observed in physiological parameters related to respiratory or cardiovascular function, a marked reduction in pain scores and anxiety levels was observed among patients exposed to music.

Limitations

Nevertheless, this study has certain limitations. The relatively small sample size, unavailable satisfaction outcome and the absence of biochemical stress markers, such as cortisol or other stress-related hormones, limit the generalizability of these findings. Future studies with larger cohorts and objective biomarker assessments may provide further insight into the physiological mechanisms underlying the observed effects. Another limitation is the use of a quasi-randomized distribution method based on file numbers, which does not include sufficient allocation concealment and carries the risk of selection bias. The absence of a group listening to silence or white noise is also a limitation. Blinding was not possible because this situation caused sound leakage/contamination between the groups. Although biopsy procedures are performed on a single nodule, the inability to calculate the nodule size and depth is another significant limitation.

CONCLUSION

These findings suggest that classical Turkish music may serve as a simple, non-invasive, and cost-effective adjunct to improve patient comfort during thyroid ultrasound-guided procedures. The observed reduction in subjective distress, despite the absence of significant physiological changes, highlights the potential psychological benefits of music-based interventions in clinical settings.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was approved by the Clinical Researches Ethics Committee of Kayseri City Training and Research Hospital (Date: 12.05.2025, Decision No: 92).

Informed Consent

Written informed consent was obtained from all individual participants prior to their inclusion in the study. Participants were fully informed about the study's aims, procedures, potential risks and benefits, and their rights—including the right to withdraw at any time without consequence. All participants voluntarily signed a written informed consent form.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Financial Disclosure

The authors received no financial support for the conduct or publication of this research.

Author Contributions

Concept: V.K., Y.B., İ.İ.B.; Design: V.K., İ.İ.B.; Control: V.K., İ.İ.B.; Data Collection and/or Processing: V.K., Y.B., M.Ç. Analysis and/or Interpretation: V.K., Y.B., M.Ç.; Literature Review: V.K., Y.B., İ.İ.B.; Article Writing: V.K., İ.İ.B., M.Ç.; Critical Review: All authors.

REFERENCES

1. Seib CD, Sosa JA. Evolving understanding of the epidemiology of thyroid cancer. *Endocrinol Metab Clin North Am*. 2019;48(1):23-35. doi: 10.1016/j.ecl.2018.10.002
2. Chen DW, Lang BHH, McLeod DSA, Newbold K, Haymart MR. Thyroid cancer. *Lancet*. 2023;401(10387):1531-1544. doi:10.1016/S0140-6736(23)00020-X
3. Barlas T, Sodan HN, Avci S, Cerit ET, Yalcin MM. The impact of classical music on anxiety and pain perception during a thyroid fine needle aspiration biopsy. *Hormones (Athens)*. 2023;22(4):581-585. doi:10.1007/s42000-023-00473-3
4. Ha EJ, Back JH, Lee JH, et al. Complications following US-guided core-needle biopsy for thyroid lesions: a retrospective study of 6,169 consecutive patients with 6,687 thyroid nodules. *Eur Radiol*. 2017;27:1186-1194. doi:10.1007/s00330-016-4461-9
5. Birgi E, Ergun O, Türkmenoğlu TT, Tatar İG, Durmaz HA, Hekimoğlu B. The contribution of vacuum-assisted modified Menghini type needle to diagnosis of US-guided fine needle aspiration biopsy of the thyroid. *Diagn Interv Radiol*. 2016;22:173-177. doi:10.5152/dir.2015.15218
6. Costa A, Montalbano LM, Orlando A, et al. Music for colonoscopy: a single-blind randomized controlled trial. *Dig Liver Dis*. 2010;42(12):871-876. doi:10.1016/j.dld.2010.03.016
7. Citlik-Saritas S, Saritas S, Cevik-Akyil R, Isik K. The effects of Turkish classical music on physiological parameters, pain and analgesic use in patients with myocardial infarction: a non-randomized controlled study. *EuJIM*. 2018;22:50-53. doi:10.1016/j.eujim.2018.08.001
8. Özdemir Ü, Taşcı S, Yıldızhan E, Aslan A, Eser B. The effect of classical Turkish music on pain severity and anxiety levels in patients undergoing bone marrow aspiration and biopsy. *Pain Manag Nurs*. 2019;20(1):82-87. doi:10.1016/j.pmn.2018.04.009
9. Yurttaş A, Şendir M, İnangil D, Kabuk A, Türkoğlu İ. The relationship between pre-clinical practice anxiety and coronavirus anxiety of nursing students in Turkiye. *J Educ Res Nurs*. 2023;20(4):305-310. doi:10.14744/jern.2022.22380
10. Aydın OU, Aydın EU. Comparison of VAS scores recorded by nurse vs surgeon: a case-control study. *J Surg Med*. 2018;2(2):74-77. doi:10.28982/josam.394318
11. Gürkan O, Kaya MF. Effect of music on anxiety and pain levels of patients undergoing thyroid fine needle aspiration biopsy: a randomized controlled study. *Acad Radiol*. 2024;31(2):538-543. doi:10.1016/j.acra.2023.09.045
12. Sosa JA, Hanna JW, Robinson KA, Lanman RB. Increases in thyroid nodule fine-needle aspirations, operations, and diagnoses of thyroid cancer in the United States. *Surgery*. 2013;154(6):1420-1426. doi:10.1016/j.surg.2013.07.006
13. Verma A, McDowell R, Porreca A. Fine-needle aspiration versus the CytoCore® motorized rotating needle device for thyroid nodule biopsies: a retrospective cohort study. *Acta Cytol*. 2024;68(5):405-412. doi:10.1159/000541374

14. Kühlmann AYR, Rooij A, Kroese JF, Dijk M, Hunink MGM, Jeekel J. Meta-analysis evaluating music interventions for anxiety and pain in surgery. *Br J Surg.* 2018;105(7):773-783. doi:10.1002/bjs.10853
15. Nilsson U. The anxiety- and pain-reducing effects of music interventions: a systematic review. *AORN J.* 2008;87(4):780-807. doi:10.1016/j.aorn.2007.09.013
16. Kilic SP, Karadag G, Oyucu S, et al. Effect of music on pain, anxiety, and patient satisfaction in patients who present to the emergency department in Turkey. *Jpn J Nurs Sci.* 2015;12(1):44-53. doi:10.1111/jjns.12047
17. Toker E, Demirel G, Doganer A, Karakucuk S. Effects of Turkish classical music on postpartum pain and anxiety in cesarean deliveries: a randomized controlled trial. *Altern Ther Health Med.* 2021;27(S1):120-127.
18. Ciğerci Y,Özbayır T. The effects of music therapy on anxiety, pain and the amount of analgesics following coronary artery surgery. *Turk Gogus Kalp Damar.* 2016;24(1):44-50. doi:10.5606/tgkdc.dergisi.2016.12136
19. Zengin S, Kabul S, Al B, Sarcan E, Doğan M, Yildirim C. Effects of music therapy on pain and anxiety in patients undergoing port catheter placement procedure. *Complement Ther Med.* 2013;21(6):689-696. doi:10.1016/j.ctim.2013.08.017
20. Uçan Ö, Ovayolu N, Savaş MC. The effect of the music that patients listen during the endoscopy of the upper gastrointestinal system, some values of the patient's, patient's satisfaction and success of the procedure. *J Nursol.* 2007;10(3):16-25.
21. Orak Y, Bakacaj SM, Yaylalı A, et al. Effects of music therapy on pain and oxidative stress in oocyte pick-up: a randomized clinical trial. *Braz J Anesthesiol.* 2020;70(5):491-499. doi:10.1016/j.bjan.2020.04.01