



Impact of music therapy and hand massage in the pediatric intensive care unit on pain, fear and stress: Randomized controlled trial



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ABSTRACT

Purpose: This study was performed with the aim of assessing the effect of music therapy and hand massage on pain, fear and stress among 12–18 year-old adolescents treated in the pediatric intensive care unit (PICU).

Design: This study was a randomized controlled trial, with single-blind design.

Methods: The adolescents were divided into groups with 33 receiving hand massage, 33 receiving music therapy and 33 in the control group. Collection of data used the Wong-Baker FACES (WB-FACES) Pain Rating Scale, Children's Fear Scale (CFS) and blood cortisol levels.

Findings: In the study, adolescents in the music therapy group had lower mean points for WB-FACES before, during and after the procedure by a significant level compared to the control group ($p < 0.05$). Additionally, the CFS mean points before and during the procedure were lowest in the music therapy group, while the music therapy and massage groups were determined to have lower points by a significant level after the procedure compared to the control group ($p < 0.05$). However, when the mean cortisol levels of adolescents before the procedure and on the 1st and 2nd day after the procedure were compared, there was no significant difference between the groups ($p > 0.05$).

Conclusions: It was determined that hand massage and music therapy were more effective than standard care at reducing pain and fear levels during blood drawing among 12–18-year-old adolescents in the PICU.

Practice implications: Nurses may use music therapy and hand massage to manage fear and pain related to blood drawing in the PICU.

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Introduction

Pediatric intensive care units (PICU) are units which involve environmental factors causing high stress and anxiety for children (Garcia Guerra et al., 2021). Additionally, children in PICU are exposed to many procedures causing pain. In one study, it was determined that the average number of painful and stressful procedures per patient per day in the PICU was 11 (interquartile range = 5–23). Endotracheal aspiration was the most common procedure (45%), followed by oral and nasal aspiration. Arterial and lumbar puncture, peripheral IV cannula insertion, and venipuncture were scored as the most painful procedures on a 3 to 10 scale. Procedural analgesia or sedation was generally not used during these most painful procedures (Baarslag et al., 2019). As a result, the primary aim of critical care, physiological stability, is endangered during painful invasive procedures (Garcia Guerra et al., 2016a, 2016b;

Garcia Guerra et al., 2021). Research reported that children display behavioral and physiological reactions during these painful procedures. Additionally, when a child feels pain, the stress hormones released may cause systemic changes like increased blood pressure, weakened immune function and delayed healing (Andersen et al., 2019; Brand & Al-Rais, 2019; Olmstead et al., 2010).

Children have the right to access appropriate pain management provided by sufficiently trained health service providers (International Association for Study of Pain, 2015). However, pain management is reported to be inadequate in PICU (Agarwal et al., 2010; Grant et al., 2012). A study related to adverse events in PICU in the United States of America considered uncontrolled pain to be one of the most commonly reported major adverse events and found that 82% of these pain events were preventable (Agarwal et al., 2010).

There are long-term psychological outcomes to a child's admission to PICU; these are affected by age, disease severity and number of invasive procedures (Rennick & Rashotte, 2009). A study observing children from 6 to 17 years treated in the PICU noted that the number of invasive procedures was the strongest predictive factor for psychological distress

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in the 6th week and 6th month after admission to the PICU (Rennick et al., 2004). For these reasons, it is necessary to perform interventions for survival, treatment and healing of the child but also about reducing pain, fear and stress in the PICU.

Among care practices, massage, one of the oldest and most common non-pharmacological methods, is a practice used to resolve pain and feelings like anxiety occurring in children admitted to the PICU (Badr et al., 2015; Koca, 2010). Massage is therapeutic stimulation via mechanical and neural pathways of the skin, subdermal tissue, muscles, internal organs, metabolism, circulation and lymph systems by hand or special devices (Badr et al., 2015; Koca, 2010). The American Massage Therapy Association defines massage therapy as “reducing and preventing pain, muscle spasm, discomfort and stress and supporting a fit and healthy life by touching the soft tissues of the body” (American Massage Therapy Foundation, 2007). Massage is applied using manipulations like stretching, pulling, flexing and pressing with the hands on soft regions of the skin (Badr et al., 2015; Koca, 2010; Kolcaba et al., 2004; Kolcaba et al., 2006). Hand massage is a holistic therapy ensuring effective development with a variety of outcomes. Hand massage is an intervention that can be easily included in nursing care activities, develops communication between the caregiver and receiver with the aid of personal care and touch, reduces anxiety, ensures comfort and relaxation, and can be easily learned and performed (Kolcaba et al., 2004; Kolcaba et al., 2006).

Music therapy, which is a non-pharmacological method, helps children to cope with painful and stressful situations (Bhasin, 2012; Klassen et al., 2008). It ensures the opportunity for socialization of children, expression of their emotions, communication and development of motor skills (Dündar, 2011; Klassen et al., 2008). Music therapy stimulates the pituitary gland. Music listened to at a low pitch and slow tempo affects the limbic system of the brain, the center of emotion and excitement, by reducing neural transmission ability to regulate emotions causing discomfort. In this way, it ensures release of endorphins and encephalins, agents which are natural pain relievers in the body and regulate mental status. It activates the parasympathetic nervous system causing reductions in physiological symptoms like blood pressure, pulse, and respiration. In conclusion, pain and anxiety levels reduce. Additionally, it has positive effects on perception (Bhasin, 2012; Heijden et al., 2015; Liu et al., 2020).

Background

Children who are critically ill and receiving treatment in a PICU may feel distress and pain, and need sedation and analgesia (Baarslag et al., 2019). Medical treatments, especially those requiring needles, can cause behavioral distress, and anxiety can make children feel pain more and interfere with the procedure (Taddio et al., 2005). Distress and pain are intertwined, and if not correctly handled, they can have a severe impact on how a child perceives pain in the future. Undertreatment of patients who are in pain or distressed has the potential to be harmful. Undertreatment can cause stress, have detrimental behavioral and physiological effects, and slow the healing process (Van Der Heijden et al., 2022).

Pain management for children in the PICU may be difficult compared to other populations. Though it is difficult to research pain in the PICU, long-term effects make studying it a critical field (Ismail, 2016; Turner, 2005). Many factors like the physical and cognitive development of the child, the nature of the child's critical status and complexity, and seriousness of disease in the critical care environment may make it difficult for health service providers to effectively assess and treat pain among children in the PICU (Ismail, 2016; Ismail et al., 2018; Oakes, 2011; Srouji et al., 2010; Turner, 2005).

Measures of pediatric pain are crucial for evaluating the efficacy of pain management. Measures of pain intensity are frequently employed; however, they are frequently applied indifferently in clinical trials. Children's pain can be measured with three different methods: self-report, observational/behavioral, and physiologic

(Tomlinson et al., 2010). Cortisol is a hormone that is released in reaction to stress and can be used to evaluate how the body reacts to stressful stimuli or to evaluate how effective a stress-reduction strategy is (Hanrahan et al., 2006). Even though cortisol and ACTH are episodically released in pulses every 30 to 120 min throughout the day, their plasma concentrations tend to peak at 8 a.m. and fall off in the evening. Minor surgery or minor illness was shown to have little impact on ACTH and cortisol secretion despite the fact that physical stress, such as major injury or severe trauma, can increase their secretion (Taylor et al., 2013).

Many therapies, including music and massage, were proven to have an impact on the autonomic nervous system. The benefits of massage therapies to control the hyperactive sympathetic nervous system and muted parasympathetic nervous system in various circumstances were already shown in a number of studies (Diego & Field, 2009; Guan et al., 2014). In comparison to children who received reading visits, children getting frequent mild massage therapy had significantly reduced state-trait anxiety scores, according to a prospective pilot study of 60 pediatric heart surgery patients older than 6 years (Staveski et al., 2018). Listening to music induces effects on hormones regulating mood and affects physiological parameters by activating the parasympathetic and endocrine system (Karamızrak, 2014). More specifically, music was shown to decrease pain, stress, anxiety and demands for analgesic and anesthetic drugs (Calcaterra et al., 2014). Nonpharmacological, complementary mind-body interventions such as music and massage may be beneficial in PICU. Based on this information, this study was planned by considering that music therapy and hand massage may have positive effects on adolescents in the PICU. Additionally, no study investigating the effect of music therapy and hand massage on pain, fear and stress among adolescents in the PICU was encountered in the literature. This study was performed with the aim of assessing the effect of music therapy and hand massage on pain, fear and stress among 12–18-year-old adolescents treated in the PICU.

Hypotheses

Hypothesis 0. Music therapy and hand massage will have no effect on pain, fear and stress among adolescents treated in the PICU.

Hypothesis 1. Music therapy and hand massage will reduce pain among adolescents treated in the PICU.

Hypothesis 2. Music therapy and hand massage will reduce fear among adolescents treated in the PICU.

Hypothesis 3. Music therapy and hand massage will reduce stress among adolescents treated in the PICU.

Methods

Study design

This study was performed as a randomized controlled experimental single-blind study with the aim of assessing the effect of music therapy and hand massage on pain, fear and stress among 12–18-year-old adolescents treated in the PICU of a Gynecology and Pediatric Hospital in Turkey. The study design and implementation were based on the principles in the CONSORT list (Consolidated Standards of Reporting Trials) (Fig. 1) (Boutron et al., 2017). Also, we used a theoretically based conceptual framework (Fig. 2) to explore the hypothesized mechanism of action and outcomes.

Study settings

The research collected data from June 2019 to December 2020 in a first-stage PICU in a hospital in Türkiye. The PICU, employing 19 nurses, contained a total of 16 beds and cared for an average of 1088 patients

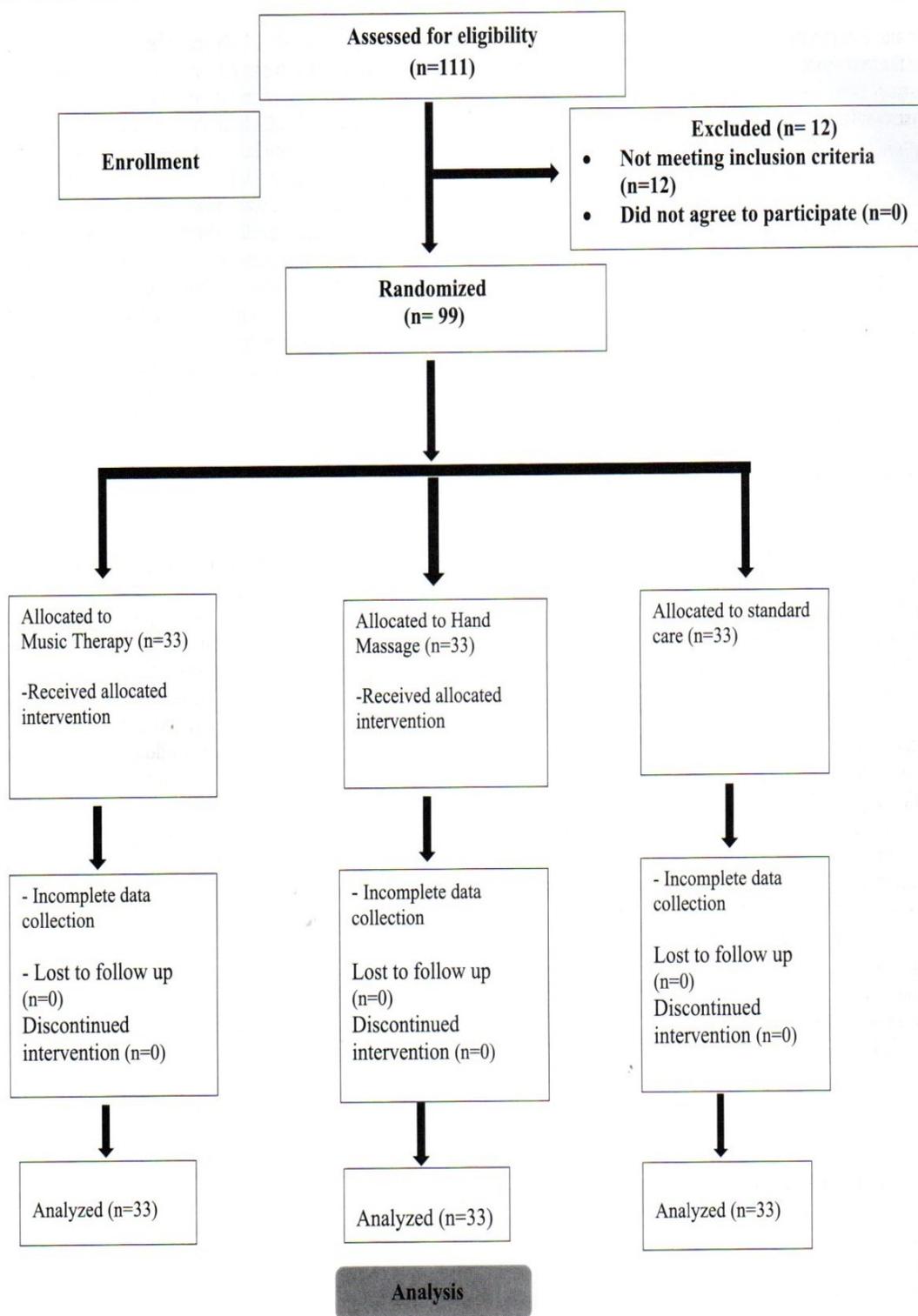


Fig. 1. CONSORT diagram showing the flow of participants (Study enrollment, randomization, and procedures).

per year. The PICU mostly offered medical care to patients requiring close monitoring due to intoxication, pneumonia, suicide attempt, trauma, status epilepticus and status asthmaticus.

Sample size

The population for the research comprised 12–18 year-old adolescents treated and cared for in the PICU of the hospital where the research was performed during the dates of the research. The research sample comprised 99 adolescents treated and cared for in the PICU of the hospital during the dates of the study, abiding by the inclusion criteria and accepting participation in the research. The sample size for the research was determined with power analysis. All calculations for power analysis were completed with the G-Power 3.1.9.7 program.

As children were assessed comparatively in 3 different groups, the ANOVA test was used as the main test for power analysis. The power analysis for the study accepted type I error level as 0.005 and type II error level as 0.20. In this situation, the sample in the study had 80% power by including a total of 99 adolescents, abiding by the inclusion criteria and accepting participation in the study, with 33 in the hand massage group, 33 in the music therapy group and 33 in the control group.

Inclusion criteria were being an adolescent aged 12–18 years, not being intubated and not receiving mechanical ventilator support, parents and child able to speak Turkish, and agreeing to participate in the research.

Exclusion criteria were cognitive dysfunction in the adolescent, surgical interventions being performed, receiving sedative or muscle-relaxant drugs, and hearing difficulty.

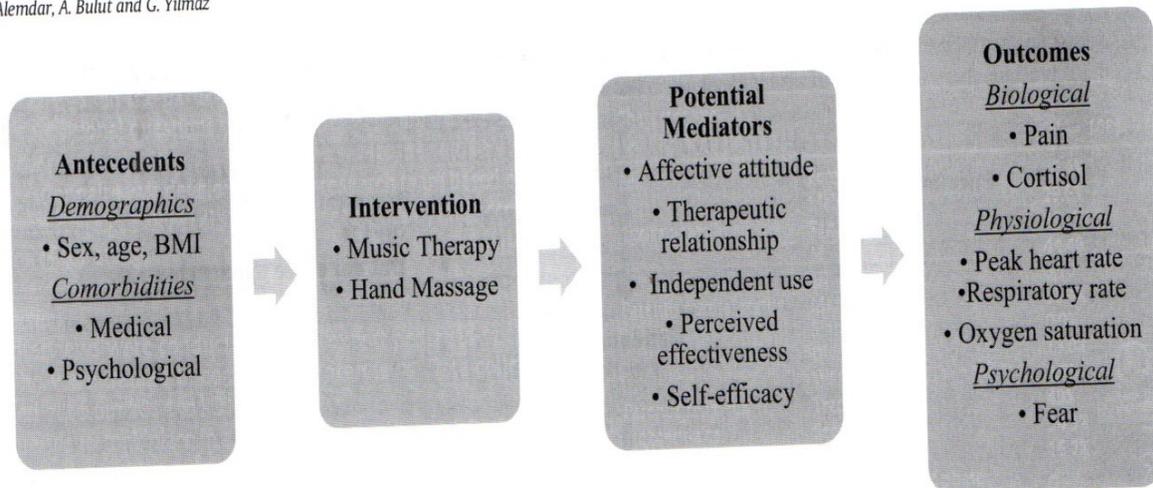


Fig. 2. Study conceptual framework.

Randomization

Assignment of participants in the research into groups was performed with a random number table creating three 33-person groups using the <https://www.random.org/> website with the 'simple randomization method.' The 1st group comprised adolescents receiving standard clinical care (control group), the 2nd group comprised adolescents receiving hand massage and the 3rd group comprised adolescents receiving music therapy. Fig. 1 shows the flowchart of the participation and group assignment.

Blinding

Due to the nature of the study, researcher could not be blinded to the group allocation. The participants were blinded. Research collection tools were applied by an experienced nurse employed in the PICU independent of the research. Information about scales used in the research was given to the nurse by the researcher. Additionally, with the aim of preventing bias during the data analysis stage, support was received from a statistics expert independent of the research.

Data collection procedure

Adolescents included in the experiment and control groups had physiological parameters, pain and fear measured at three time points during a blood sample procedure: T1 10 min before the painful procedure, T2 during the painful procedure and T3 10 min after the blood sample procedure. Measurements were repeated three times at the same time points for the experiment and control groups. The application time of data collection tools for all groups is approximately 2 min. During admission to the PICU, adolescents included in the experiment and control group had blood samples taken on the morning after admission at 08:00 and on the following day at 08:00 to analyze cortisol levels with the aim of assessing stress levels.

Control group: Children included in this group did not have any non-pharmacological method applied. Adolescents included in this group received routine care practiced in the intensive care unit. After admission of the adolescents to the PICU and necessary medical interventions, physiological parameters, pain and fear were assessed before the painful procedure. Then the venous route was accessed and a blood sample taken for routine blood tests. This blood sample also had cortisol analysis performed. The physiological parameters, WB-FACES and CFS scores of control group was evaluated at the 10 min before blood sample, during blood sample, and at the 10 min after blood sample.

Music Therapy group: The music therapy application began 10 min before the painful procedure and continued during and after the

procedure for a total of 20 min with a 'music pillow' (Creatone music pillow). The time, length, and frequency of the intervention were chosen based on the minimal data available (Moore, 2013; Nilsson, 2008; Stouffer et al., 2007). Classical music listened to by the study group in the research was a short piece chosen with nearly 60-beat tempo, without dramatic moments, disturbing chords and mismatched minors, and in a major key selected by a classical music therapist in line with expert opinion and the literature (Bernatzky et al., 2011; Moore, 2013). The piece was slow and had soft movement. Additionally, a calm mental state was present in the piece. The physiological parameters, WB-FACES and CFS scores of music therapy group was evaluated at the 10 min before blood sample, during blood sample, and at the 10 min after blood sample.

Hand Massage group: In line with the protocol, the hand massage practice began 10 min before the painful procedure and continued during and after the procedure for a total of 20 min. The researcher was trained in the practice of massage. Massage began with the right hand and continued with the left hand. Classic massage techniques were used for hand massage. The massage began on the back of the hand and after effleurage 5 times for the whole back of the hand with the palm, effleurage was performed on each finger singly from the end joints to the bottom joints. Later palm massage began. For palm massage, the researcher supported the patient's hand with their free hand and performed effleurage for the whole palm to the wrist with their other hand. After effleurage ended, surface friction was applied with the thumb to the finger joints and bottom joints. After friction, petrissage was performed for the tenar and hypotenar muscle groups with the fingers. Later general effleurage was performed for the hand and the massage was ended (Mason et al., 1999; Sparks, 2001).

The physiological parameters, WB-FACES and CFS scores of the hand massage group was evaluated at the 10 min before blood sample, during blood sample, and at the 10 min after blood sample.

Outcome measures

Adolescent Descriptive Information and Monitoring Form: This was a questionnaire prepared by the researchers obtaining descriptive information about the child's age, sex, education, BMI and chronic disease status. Additionally, this form included a monitoring form recording physiological parameters of children like peak heart rate (pHR), respiratory rate and oxygen saturation (SpO₂).

Wong-Baker FACES (WB-FACES) Pain Rating Scale: This scale is used to rate pain in children. This scale moves from zero to five from left to right, and contains six faces representing increasing severity of pain along this scale. The left-most face shows a pain-free situation with a smiling face, while the right-most face has a crying expression

equivalent to the most severe pain. The six facial expressions are rated from left to right from 0 to 5 (0 = very happy/no pain, 5 = most severe pain). Increasing points obtained from the scale show falling tolerance of pain, while tolerance increases as points reduce. The child is told to choose the face that best represents how they feel (Wong & Baker, 1988).

Children's Fear Scale (CFS): The CFS is used to measure fear levels in children. The CFS is a scale rating from 0 to 4 with five drawn facial expressions changing from a neutral expression (0 = no fear) to a frightened face (4 = severe fear). It may be used to assess children for pain and fear before, during and after procedures by families and researchers (McMurtry et al., 2011). The CFS was created based on the Faces Anxiety Scale developed to measure fear in adults admitted to the intensive care unit. Fearful expressions were drawn by a graphic artist based on facial muscle changes in photographs of frightened faces (McMurtry et al., 2011).

Stress response

During ICU admission of adolescents, blood samples were taken from the antecubital vein at 8:00 am the morning after admission and the following morning at 8:00 am and placed in biochemistry tubes. Blood samples were used to both monitor the clinical status of the adolescent and to detect cortisol levels in our study. No invasive procedure was performed for the study. To determine plasma cortisol levels, the chemiluminescent method was used with a Roche Cobas E602 brand device. For plasma cortisol levels in the morning, 4.82–19.5 µg/dl was accepted as the normal interval.

Ethical considerations

In order to perform this study, permission was granted by the Ethics Committee (dated 09/05/2019 and numbered -E.11024) and by the Provincial Health Administration. Children and parents had the aim and method of the research explained, and were told they could withdraw from the research without reason at any point if they did not want to continue. Written informed consent was obtained from children and parents. Children and parents were told that information would be kept confidential and not used for any other purpose. Thus, the study abided by all ethical principles related to informed consent, volunteerism and protection of privacy of human subjects and protected individual rights.

Data analysis

Statistical analysis was conducted using the SPSS Statistics software for Microsoft Windows XP (Version 25.0, SPSS Inc., Chicago, IL). Data obtained as a result of the research are given as number, percentage,

mean, and standard deviation values using descriptive statistical tests. Fit of variables to normal distribution was assessed with the Shapiro Wilk normality test, Q-Q graphs and histograms. With the aim of determining differences in terms of demographic features between the subject groups, analysis of quantitative data used the variance analysis and Pearson chi-square test. Comparison of groups according to group mean points for fear (CFS) and pain (WB-FACES) used variance analysis (ANOVA). Identification of groups causing differences as a result of the ANOVA test used the Bonferroni test for those with homogeneous variance. The level of significance was set at $p < 0.05$.

Results

Comparison of descriptive characteristics of the control and intervention groups

The study included 99 children. The characteristics of children are presented in Table 1. There were no statistically significant differences between the control and intervention groups in terms of age, BMI, family type and chronic disease ($p > 0.05$). However, there were statistically significant differences between the control and intervention groups in terms of sex ($p < 0.05$).

Comparison of physiological parameters between the control and intervention groups

Assessment of physiological parameters in control and intervention groups is shown in Table 2. Comparison of peak heart rate of children at T1 between the groups found a statistically significant difference ($p < 0.05$). Post-hoc Bonferroni test results, performed to determine which group caused the difference, found the difference was due to the hand massage group and children in this group had higher peak heart rate before the intervention ($p < 0.05$). However, at T2 and T3, comparison of peak heart rate of children in the groups did not find any statistically significant difference ($p > 0.05$). Additionally, comparison of SO_2 and respiratory rate between the control and intervention groups did not find any statistically significant difference ($p > 0.05$).

Comparison of Wong-Baker FACES scores between the control and intervention groups

Evaluation of pain (WB-FACES) level between control and intervention groups is shown in Table 3. Comparison of pain levels of adolescents at T1, T2 and T3 found statistically significant differences between the groups ($p < 0.05$). As a result of the post-hoc Bonferroni test performed to identify which group caused the difference, the difference was due to the music therapy group. Adolescents in this group had lower pain points at T1, T2 and T3 ($p < 0.05$).

Table 1
Comparison of descriptive characteristics of the control and intervention groups (N = 99).

Variables	GROUPS			Statistics test P-value
	Music Therapy group ¹ (n = 33) Mean (SD) n (%)	Hand Massage group ² (n = 33) Mean (SD) n (%)	Control group ³ (n = 33) Mean (SD) n (%)	
Gender				
Male	23 (69.7)	30 (90.9)	30 (90.9)	$\chi^2 = 7.306$
Female	10 (30.3)	3 (9.1)	3 (9.1)	$p = 0.026$
Age	15.51 ± 1.14	15.72 ± 1.56	15.33 ± 2.30	F = 0.424 p = 0.655
BMI (Body Mass Index)	17.76 ± 2.90	18.10 ± 3.23	16.98 ± 3.45	F = 1.065 p = 0.349
Family type				
Extended family	4 (12.1)	3 (9.1)	0 (0.0)	$\chi^2 = 3.997$
Nuclear family	29 (87.9)	30 (90.9)	33 (100.0)	p = 0.136
Chronic disease				
Yes	30 (90.9)	27 (81.8)	29 (87.9)	$\chi^2 = 1.240$
No	3 (9.1)	6 (18.2)	4 (12.1)	p = 0.538

Table 2
Comparison of physiological parameters between the control and intervention groups (N = 99).

Physiological Parameters	GROUPS			F	p	Paired Comparisons ^a		
	Music Therapy group ¹ (n = 33)	Hand Massage group ² (n = 33)	Control group ³ (n = 33)			1–2	1–3	2–3
	Mean (SD)	Mean (SD)	Mean (SD)					
T1 Heart Rate	81.00 (10.96)	88.03 (12.02)	84.00 (12.34)	3.908	0.023	*	-	*
T2 Heart Rate	78.24 (10.37)	84.54 (12.92)	80.15 (10.59)	2.674	0.074	-	-	-
T3 Heart Rate	80.84 (7.22)	81.60 (10.88)	76.33 (11.06)	2.744	0.069	-	-	-
T1 SO ₂	97.66 (1.61)	97.87 (1.34)	97.54 (1.03)	0.515	0.599	-	-	-
T2 SO ₂	97.93 (1.08)	97.96 (1.13)	97.78 (1.05)	0.263	0.769	-	-	-
T3 SO ₂	98.21 (1.26)	98.39 (1.08)	97.96 (1.13)	1.101	0.337	-	-	-
T1 Respiratory Rate	18.93 (1.65)	19.45 (2.46)	19.00 (2.31)	0.553	0.557	-	-	-
T2 Respiratory Rate	18.30 (1.48)	18.96 (3.77)	17.54 (1.39)	2.726	0.071	-	-	-
T3 Respiratory Rate	18.39 (1.76)	18.15 (1.50)	18.39 (1.17)	0.287	0.804	-	-	-

SD = standard deviation;

^aSignificance levels for Bonferroni test comparing Music-Therapy-Hand Massage (1–2), Music-Therapy - Control (1–3), and Hand Massage- Control (2–3) paired comparisons: *p < 0.05.

Comparison of Children's Fear Scale scores between the control and intervention groups

Assessment of mean CFS points between the control and intervention groups is presented in Table 4. Comparison of fear levels of adolescents at T1, T2 and T3 found a statistically significant difference between the groups (p < 0.05). The results of the post-hoc Bonferroni test performed to determine which group caused the difference found the difference was due to the music therapy group before the intervention. Adolescents in the music therapy group were identified to have lower fear points at T1, T2 and T3 (p < 0.05).

Comparison of cortisol scores between the control and intervention groups

Evaluation of cortisol levels in the control and intervention groups is given in Table 5. Comparison of mean serum cortisol levels of adolescents before the procedure, on the 1st day and 2nd day found no significant difference between the groups (p > 0.05).

Discussion

In our study, significantly lower points were identified for fear and pain in adolescents receiving music therapy during blood drawing in the PICU, supporting hypotheses H1 and H2 (p < 0.05). Music therapy is a safe and generally accepted non-pharmacological intervention to lessen symptoms and improve quality of life in terms of pediatric health (Stegemann et al., 2019). When the literature is investigated, a study with pediatric patients determined that music was an effective method to reduce pain forming after a major surgical intervention

(Suresh et al., 2015). A study of nurses and doctors reported that music was chosen at rates of 75% among non-pharmacological comfort methods that should be used commonly for intubated children (Garcia Guerra et al., 2016a, 2016b). Another study of pediatric patients listening to music found that children had lower morphine requirements and lower mean stress and pain points (Nilsson et al., 2009). A study of adolescents by Lin et al. (2021) identified that music therapy effectively reduced chronic pain in postoperative patients and additionally increased postoperative quality of life and sleep quality. Bulut et al. (2020) found that postoperative music therapy reduced postoperative anxiety levels among children. A study by Calcaterra et al. (2014) found listening to music for 20 min through speakers during recovery in the postoperative period for children aged 3–14 years had positive effects on cardiovascular parameters and stress-linked hyperglycemia but was not effective on pain. Studies using music in mechanically-ventilated adults found that music was associated with lower levels of anxiety and lower sedation requirements (Bradt & Dileo, 2014; Chlan et al., 2013). Music is a form of distraction to lessen pain and distress experienced by children during medical procedures. Music was shown to reduce procedural pain and anxiety in a variety of clinical environments (Hartling et al., 2013; Heijden et al., 2015; Weeks & Nilsson, 2011). These results show that music therapy is an important non-pharmacological method and should be an important consideration during care of children.

In our study, adolescents with hand massage were found to have reduced fear points compared to the control group after the procedure and this supports H2 hypothesis (p < 0.05). Staveski et al. (2018) identified reduced anxiety levels in children given massage in the postoperative period in their study of children undergoing cardiac surgery. Aşkan (2018) stated that hand massage performed for children before

Table 3
Comparison of Wong-Baker FACES scores between the control and intervention groups (N = 99).

Wong-Baker FACES	GROUPS			F	p	Paired Comparisons ^a		
	Music Therapy group ¹ (n = 33)	Hand Massage group ² (n = 33)	Control group ³ (n = 33)			1–2	1–3	2–3
	Mean (SD)	Mean (SD)	Mean (SD)					
T1	0.69 (0.58)	1.39 (0.74)	1.12 (0.73)	8.429	0.000	*	*	-
T2	0.27 (0.57)	0.69 (0.60)	0.72 (0.71)	4.732	0.011	-	*	-
T3	0.15 (0.36)	0.27 (0.45)	0.45 (0.50)	3.895	0.024	-	*	-

SD = standard deviation;

^aSignificance levels for Bonferroni test comparing Music-Therapy-Hand Massage (1–2), Music-Therapy - Control (1–3), and Hand Massage- Control (2–3) paired comparisons: *p < 0.05.

Table 4
Comparison of Children's Fear Scale (CFS) scores between the control and intervention groups (N = 99).

CFS	GROUPS			F	p	Paired Comparisons ^a		
	Music Therapy group ¹ (n = 33) Mean (SD)	Hand Massage group ² (n = 33) Mean (SD)	Control group ³ (n = 33) Mean (SD)			1-2	1-3	2-3
T 1	0.51 (0.50)	0.96 (0.58)	1.27 (0.80)	11.58	0.000	*	*	-
T 2	0.24 (0.43)	0.57 (0.50)	0.78 (1.06)	7.121	0.001	-	*	-
T 3	0.06 (0.24)	0.09 (0.29)	0.33 (0.47)	5.929	0.004	-	*	*

SD = standard deviation;

^aSignificance levels for Bonferroni test comparing Music-Therapy-Hand Massage (1-2), Music-Therapy - Control (1-3), and Hand Massage- Control (2-3) paired comparisons: *p < 0.05.

surgery significantly reduced anxiety levels. The results of a study performed with the aim of determining the effects of hand and foot massage on the central nervous system of children admitted to the PICU determined that massage developed central nervous system functions and had positive effect on the stress response (Guan et al., 2014). Van Der Heijden et al. (2022) found aromatherapy massage in the PICU increased children's comfort and reduced anxiety. A study by Jalalodini et al. (2016) determined that massage reduced anxiety developing linked to hospitalization for school-age children. Massage is thought to ensure easier communication between the adolescent and health team with the comforting effect of touch, and allow easier expression of feelings and thoughts and thus reduce fear in adolescents. Additionally, as a result of adolescents focusing attention during massage, liking massage and feeling better with massage, it is thought fear will reduce. It is also thought that this result obtained from the study depends on the physical relaxation of the adolescent and the development of a trust relationship with the practitioner.

Practice implications

Inclusion of hand massage and music therapy in nursing care routinely applied to children treated in the PICU will be beneficial practices to ensure physiological stability and reduce pain and fear. Implementing non-invasive, free, and easily applied methods like music therapy and hand massage in the PICU should be popularized. It may be recommended that the combination of pharmacological methods along with the use of non-pharmacological methods like hand massage and music therapy be included in procedures applied in the PICU. It is recommended that health employees receive training about pain-relieving methods in the PICU and that this training be repeated at certain intervals.

Limitations

There are several known limitations related to this study. First, adolescents might have responded differently to fear and pain based on their physical condition, emotional and cultural states. Secondly, there were significant differences in sex between adolescents included in the intervention and control groups. Additionally, the findings of the research are limited to assessment of the effect of music and hand

massage performed in the PICU on fear, pain, stress and physiological parameters. The results are only applicable to blood drawing, and not necessarily to other painful procedures encountered in PICU. As the research was completed with adolescents aged 12–18 years, it cannot be generalized to children in other development periods.

Conclusion

In our study, music therapy was found to reduce pain in adolescents during blood drawing in the PICU. Additionally, it was determined that adolescents given music therapy and hand massage experienced less fear compared to the control group. In line with the results, it is recommended that health professionals working in pediatric clinics be informed during in-service training about the importance of reducing fear and pain, and the efficacy and use of non-pharmacological methods like music therapy and hand massage that can be easily applied with no cost. Additionally, it is suggested that non-pharmacological methods be included in nursing care interventions, that nurses be encouraged to apply these methods and that parents be trained for inclusion in this care. The research should be repeated with different sample groups and higher subject numbers.

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CREDIT Statement

All authors made substantial contributions to the conception and design of the study and the acquisition and interpretation of the data. All the authors drafted the article or critically revised it for intellectual content.

Ethical considerations

To conduct this study, permission was obtained from the Ethics Committee (dated 09/05/2019 and numbered E.11024) using the ethical consent form. The aim and the method of the study were explained to the children and their parents, and they were informed that if they did not want to continue, they could withdraw from the study without

Table 5
Comparison of cortisol scores between the control and intervention groups (N = 99).

Cortisol	GROUPS			F	p	Paired Comparisons ^a		
	Music Therapy group ¹ (n = 33) Mean (SD)	Hand Massage group ² (n = 33) Mean (SD)	Control group ³ (n = 33) Mean (SD)			1-2	1-3	2-3
During ICU admission	12.35 (3.99)	13.02 (4.55)	11.24 (3.60)	1.604	0.206	-	-	-
1. day morning (8:00 am)	11.62 (3.51)	10.53 (4.46)	11.99 (3.97)	1.185	0.310	-	-	-
2. day morning (8:00 am)	11.34 (4.18)	10.85 (5.14)	10.68 (3.75)	0.203	0.817	-	-	-

SD = standard deviation;

^aSignificance levels for Bonferroni test comparing Music-Therapy-Hand Massage (1-2), Music-Therapy - Control (1-3), and Hand Massage- Control (2-3) paired comparisons: *p < 0.05.

stating a reason. Written informed consent was obtained from children and their parents. The children and their parents were assured that the information they gave would be confidential and would not be used for any other purpose. The study thus fulfilled all the relevant ethical principles of informed consent, voluntariness, and the protection of the privacy protection of human subjects and safeguarded their individual rights.

Declaration of Competing Interest

The authors declare that they have no conflict of interests.

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