RESEARCH

The effect of listening to music and drawing on coping with dysmenorrhea complaints in nursing students: randomized controlled trial

Burcu Küçükkaya^{1*} and Şükran Başgöl²

Abstract

Aim To examine the effect of listening to music and drawing on coping with dysmenorrhea complaints of nursing students.

Methods The study was a double-blind, three parallel-group randomized controlled trial conducted between August 2023 and May 2024 at Bartin University, Faculty of Health Sciences, Department of Nursing. Ninety-six dysmenorrheic nursing students with regular menstrual cycles were included in the study and randomly assigned to three groups as drawing, music and control groups. Visual Analog Scale (100mmVAS of pain), Perceived Stress Scale (PSS) and Menstrual Symptoms Scale (MSS) were applied to the students at baseline, 1st and 2nd months. The interventions were as follows: the music group listened to a 29-minute and 32-second song three days before menstruation and on the first day of menstruation in the third month composed by Juan Sebastian Martin-Saavedra, while the drawing group created art for the same duration. The pain scores, perceived stress, and menstrual symptoms were measured in all groups after the interventions.

Results Pretest, 1st and 2nd months 100mmVAS of pain score averages were 7.16 ± 1.99 , 7.16 ± 1.99 and 7.50 ± 1.98 for the control group, 7.22 ± 1.64 , 4.84 ± 1.80 and 2.13 ± 1.45 for the music group and 6.69 ± 1.80 , 5.09 ± 1.55 and 2.91 ± 1.33 for the drawing group, respectively. Pretest, 1st and 2nd months PSS score averages were 28.75 ± 3.71 , 29.09 ± 3.87 and 30.03 ± 4.16 for the control group, 29.91 ± 3.98 , 14.06 ± 4.06 and 3.59 ± 3.82 for the music group and 27.38 ± 3.63 , 18.13 ± 5.60 and 8.34 ± 5.46 for the drawing group, respectively. Pretest, 1st and 2nd months MSS score averages were 79.25 ± 15.41 , 88.00 ± 20.08 and 90.66 ± 19.13 for the control group, 85.41 ± 10.77 , 62.41 ± 15.23 and 34.00 ± 12.62 for the music group and 80.69 ± 11.07 , 65.53 ± 15.37 and 47.31 ± 15.11 for the drawing group, respectively. Mean menstrual pain intensity, mean perceived stress level, and mean menstrual symptoms level in the art and music group decreased significantly at 1st and 2nd months post-intervention (p < .001). A significant increase in score levels was observed in the control group.

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Conclusions Both art and music practices are effective in significantly reducing menstrual pain, perceived stress, and menstrual symptoms in nursing students with dysmenorrhea. It is important to include listening to music and drawing on women's health and disease nursing practices to control menstrual pain, perceived stress, and menstrual symptoms in dysmenorrhea.

Clinical trials registration number https://clinicaltrials.gov identifier NCT06027489; registered August 30, 2023. **Keywords** Coping behavior, Drawing, Dysmenorrhea, Menstrual pain, Music, Nursing students

Introduction

Menstrual cycle disorders are quite common among adolescent girls and women of reproductive age [1]. Dysmenorrhea, one of the disorders, is categorized as primary and secondary dysmenorrhea [1, 2]. Primary dysmenorrhea (PD) is described as painful menstrual cycle or cramps felt in the lower abdomen before and/or during menstrual cycle without a clinically defined organic pathology [3]. Secondary dysmenorrhea (SD), on the other hand, refers to menstrual pain caused by anatomical and/or significant pelvic pathology such as endometriosis [4]. The onset of PD usually occurs during puberty (<20), approximately 6–24 months after menarche, and is characterized by painful cramps lasting 8-72 h, which are most severe on the first or second day of menstrual cycle [4, 5]. Typically, the pain is accompanied by symptoms such as vomiting, dizziness, insomnia and fatigue and is usually characterized by menstrual cycle pain, fatigue, and mood changes [5, 6]. In contrast to PD, SD occurs after age 25 [7]. When the studies conducted in different countries between 2021 and 2023 were examined, 91.5% in Ireland, 97.7% in Sri Lanka, 91.5% in Pakistan, 75.9% in Zimbabwe, 64.7% in Ethiopia, 79.4% in Saudi Arabia, 79.4% in Saudi Arabia, 62.4% in Mexico and 76.5% in Turkey, it was found that the prevalence of dysmenorrhea was high in reproductive age women who were university students [8-14].

It is reported that dysmenorrhea, which has a high prevalence, causes the loss of many working days (workschool) every year [2, 5, 15–17]. It also affects women's individual quality of life, daily activity, and performance [18]. In the face of this situation, the nurse can provide psychological support to young women with dysmenorrhea by first getting them to recognize themselves (such as why they menstruate), thus helping them overcome their fear and suggesting that their menstruation may be more painless. In cases where education is insufficient, it was also explained that non-pharmacological methods or direct pharmacological treatment options exist [19]. Obviously, the treatment of dysmenorrhea is multifaceted, and for most women, it may be sufficient to use some practices other than drugs to prevent pain [20].

Non-pharmaceutical approaches are widely used for the symptoms of dysmenorrhea; one of these approaches is music therapy (MT), and the other is art therapy (ST)

[21]. The American Music Therapy Association (AMTA) defines music listening, a step of music therapy, as an approach to protect, maintain, and improve individuals' physical and mental health; a synoptic review of the history of human life demonstrates this fact [22, 23]. Listening to music has various positive properties including reducing stress, and arousal, alleviating pain, and promoting relaxation by influencing heart rate, blood pressure, and the release of endorphins, and balancing emotional states on individuals and is effective in the treatment of anxiety [24], depression [24], alleviation of dysmenorrhea [21], and various other diseases. These positive results can be explained by the characteristics and physiological effects of music. According to Western music theory, music is defined as "the art of organizing sounds" and its characteristics are divided into two categories: the physical characteristics of the sound (volume, pitch, and waveform) and the characteristics of the musical piece (melody, harmony, rhythm, and instrumentation). Rhythm is defined in terms of tempo and time signature, while beat gives the temporal quality of the musical piece. Using these terms will allow researchers to objectively categorize music and standardize interventions. Although there are no definitive results in the literature on the reduction of menstrual pain in terms of rhythm, sound level, or decibel, it is stated that the sound level should not be at the noise level (51 to 75 dB) in the management of pain [25, 26]. Recent neuroscientific studies have shown that music can reduce the physiological arousal and pain that increases during stress. Listening to music has been associated with a decrease in physiological arousal and pain, as shown by decreased cortisol levels, heart rate, and blood pressure [27–31].

In art therapy, the ability of art to reach the mind, body, and soul simultaneously is emphasized, and it is seen that art activities strengthen their participation in the therapeutic process by creating an environment that will make young people feel safe and comfortable [32]. With drawing, a branch of art therapy, catharsis is achieved by confronting repressed, ignored, and unexpressed emotions with the help of art therapy. After confronting unrecognized and suppressed emotions, the process of transition to creative aspects can begin [33]. In this respect, drawing helps individuals increase their awareness, bring traumatic memories to the surface, and resolve conflicts. Drawing can be practiced with individuals of all ages. This method is particularly effective for individuals who cannot express themselves verbally. It is thought that drawing will provide relaxation in individuals, change the focal point, and reduce arousal [33, 34]. By drawing, individuals can express and externalize memories and emotions in visual art and combine implicit and explicit memory [33, 34].

It is obvious that music listening and drawing methods have an important place in coping with individuals' mental and physical problems and play an active role in the management of processes. Examining the literature, no international or national study with a high level of evidence examining the comparison of listening to music and drawing in managing dysmenorrhea symptoms was found. Therefore, the researchers aimed to examine the effect of listening to music and drawing in coping with dysmenorrhea complaints of nursing students with dysmenorrhea. The study is thought to be original, in line with the purpose of the study, and makes an important contribution to the literature.

Methods

Study design

The study was a single-center, double-blind, prospective, three parallel-group randomized controlled trial conducted between August 2023 and May 2024 at Bartin University, Faculty of Health Sciences, Department of Nursing. Female undergraduate nursing students were followed up for three menstrual cycles. In the first menstrual cycle, menstrual pain, menstrual symptoms, and perceived stress level formed the baseline scale. Two interventions, drawing and listening to music, were implemented in the second and third menstrual cycles. The study protocol and analysis plan were prospectively registered (NCT06027489). This study followed the Consolidated Standards of Reporting Trials (CONSORT) reporting guideline extension for cluster trials. Our study complied with CONSORT guidelines. The CONSORT flow diagram of the study design is presented in Fig. 1.

It is important to explicitly address the control of extraneous variables in our randomized controlled trial, and we implemented several strategies to control for these variables in our study. Specifically, randomization was used to assign participants to the music, drawing, or control group, ensuring that extraneous variables were distributed equally. To control for bias and confounding factors, we implemented blinding procedures for both participants and investigators. We standardized intervention protocols to ensure consistency. Inclusion and exclusion criteria were carefully defined to control for variables that could affect the validity of the study.

Sample size and statistical power considerations

The power analysis of this study was performed with G*POWER 3.1.9.7 (Power analysis statistical software). In determining the sample size, the menstrual pain intensity value was taken as the basis, taking the study of Selcuk and Baysal (2022) as a reference. With an effect size of 0.75, α =0.05 margin of error, and minimum power=80% (β =0.2%), it was determined that 28 individuals from each group would be sufficient to participate in the study [21]. However, considering the possible missing data, it was decided to include 32 female nursing students in the study, with a 10% increase in each group.

In this study, simple random sampling method was used. Participation in the study was made to students studying at the institution where the study was conducted through announcements, e-mails, and posters. The information of interested students was recorded and evaluated in terms of eligibility criteria. Eligible students were informed about the study objectives and that they would be randomly assigned to a silence group, a drawing group, and a music group. However, the study hypothesis was not disclosed to avoid the expectation bias effect. Female students who agreed to participate in the study were assigned to one of three groups that constituted the procedure of the study: control, drawing and music. Considering an expected 10% loss rate in August 2023, 96 nursing students with dysmenorrhea were identified for this study. The follow-up period covered the baseline and 2 months. Although 108 nursing students initially applied for the study, all 96 nursing students who met the inclusion criteria were included in the ITT analysis. A total of 96 female nursing students, 32 of whom were assigned to the control, drawing and music groups, respectively (Fig. 1).

A post-doc power analysis was performed to justify the sample size of this study. It was calculated with the "G. Power-3.1.9.2" program at a 99% confidence level and =0.01. The study's main hypothesis, the difference between pain, menstrual symptoms, and stress levels of the groups, was tested by analysis of variance. For menstrual pain, the effect size was 0.47, and the strength was 0.83, while for the menstrual symptom level, the effect size was 0.51, and the strength was 0.94. It was determined that the calculated and reached sample size had sufficient power for the research.

Participants

The study included 1st, 2nd, 3rd, and 4th-year female nursing students of Bartin University Faculty of Health Sciences, Department of Nursing, aged 18–25 years old (years), with a Visual Analog Scale (100mmVAS of pain) severity of 5 or higher and a regular menstrual cycle (28 ± 7 days) in the previous year in the 2023–2024 academic year. We included those without pelvic pathology,



Fig. 1 Study flowchart

hearing loss, endocrine, neurologic, or chronic diseases and psychiatric disease such as diabetes mellitus or heart disease, current use of medication such as oral contraceptives or antidepressants, menstrual irregularities, mental problems that interfere with assessment and collaboration, pelvic surgery, malignant condition, obesity, previous pregnancy, advanced drawing training, advanced music training, use of vitamin supplements. Participants who used medication, non-pharmacological practice (acupressure, reiki, reflexology, meditation) or any nutritional supplement to reduce pain were also excluded. Female students participating in the study were told that they should not use analgesics in order to evaluate the effectiveness of the applications applied throughout the study, and that they could use analgesics if severe and unbearable pain continued after the pain evaluation made after the applications. The inclusion criteria were questioned before the nursing students were included in the study and during the 1st and 2nd months evaluations. Additionally, analgesic use was questioned while the participants' follow-up data were collected.

Randomization and blinding

The randomization list was made by another scientist who was not involved in the research process to maintain the randomization order and prevent bias, and this blinding ensured that group allocation was concealed. A computer randomization program was used to create the randomization list for the intervention allocation sequence. Individuals who volunteered to participate in the study and whose consent forms were obtained were randomly assigned to the experimental and control groups using the blocking method. Following bloc randomization procedures, participants were assigned to one of the three arms of the trial in a 1:1:1 ratio according to a computer-generated randomization schedule via https://www.sealedenvelope.com/simple-randomiser/v1.

This study uses a double-blind RCT. Therefore, nursing students with dysmenorrhea who were included in the study were informed about their group by the scientist who provided randomization and was not part of the study team, and they were allowed to share their problems related to listening to music or drawing with the independent scientist. The researchers communicated with the dysmenorrheic nursing students included in the study during the initial data collection phase and the interim measurements follow-up. Due to the nature of double-blind research, allocation of participants to groups, implementation of interventions, and statistical analysis of research findings were performed by scientists not involved in the study. There is no similarity between the interventions implemented in this study.

Instruments

The questionnaire comprised four parts. Socio-demographic characteristics and characteristics related to the menstrual cycle consisted of 36 questions in total. Sociodemographic characteristics included questions such as age, height, weight, body mass index (BMI), mother's education level, mother's employment status, father's education level, father's employment status, income status, family type, smoking status, alcohol consumption status, physical exercise status, place of residence during education, dominant personality structure, and perspective on life. Menstrual cycle-related characteristics included age at first menarche, duration and frequency of menstrual cycle, regularity of menstrual cycle, reaction to waiting for menstruation before menstruation, cramping pain in the lower abdomen (dysmenorrhea) in the first days of menstrual cycle, The questionnaire included questions on the problems experienced during the menstrual cycle and coping methods, duration of dysmenorrhea complaint, use of pharmacological treatment methods in dysmenorrhea, use of traditional and alternative treatment methods in dysmenorrhea, information source and sharing with health professionals if using, and the status and frequency of emergency room visits with dysmenorrhea complaint [21, 25, 26]. The researchers prepared the questions in line with the literature, and expert opinion was obtained after the questionnaire was prepared.

The Visual Analogue Scale (100mmVAS of pain) constituted the second part of the survey. The level and severity of menstrual pain will be measured using the 100mmVAS of pain, a valid and reliable tool for measuring experimental and clinical pain [32]. The 100mmVAS of pain is scored on a horizontal line of 10 cm (0=no pain and 10=worst possible pain).

In the third part of the questionnaire, the Menstrual Symptom Scale (MSS) was used to assess menstrual symptoms. Chesney and Tasto developed this scale in English in 1975 to assess menstrual pain and symptoms. It is a widely used scale in the United States and many other countries. In 2009, it was updated by Negriff et al. by re-evaluating its factor structure and usability in adolescents. The scale was adapted into Turkish by Güvenç et al. in 2014 [35]. Participants are asked to assign a number between 1 (never) and 5 (always) to the symptoms they experience related to menstruation. The scale items were numbered based on the factors allocated for ease of use. Items 1-13 belong to the "Negative effects/somatic complaints" subscale, items 14-19 belong to the "Menstrual pain symptoms" subscale, and items 20-22 belong to the "Coping methods" subscale. Cronbach's Alpha value is 0.86. It is a five-point Likert-type scale consisting of 22 items. The score obtained from the sub-dimensions is calculated by averaging the total score of the items in the sub-dimensions [35]. An increase in the mean score for the subscales indicates an increase in the severity of menstrual symptoms related to that subscale [33]. The Cronbach's alpha value of the scale is 0.86 [35]. In this study, the Cronbach alpha value for the MSS was found to be 0.97.

In the fourth part of the questionnaire, the Perceived Stress Scale (PSS) was used to assess the level of perceived stress. This self-assessment scale was developed by Cohen, Kamarck, and Mermelstein (1983) [36]. The total score that can be obtained from the scale is 32. The scale consists of a total of 10 items and is scored between 0 and 4. A high total score indicates a high level of stress. This study used the scale whose Turkish validity and reliability study was conducted by Bilge et al. in 2009 [36, 37]. The Cronbach's alpha value of the scale is 0.86 [37]. In this study, the Cronbach alpha value for the MSS was found to be 0.99.

Data collection

All participants completed the 100mmVAS of pain, MSS, and PSS to assess current pain, menstrual symptoms, and perceived stress levels before the interventions in the first month of participation in the study. In the second and third months, 100mmVAS of pain was completed on the first day of the menstrual cycle to assess menstrual pain intensity, MSS was used to assess menstrual symptom status, and PSS was used to assess perceived stress. When the literature was examined, it was reported that the prostaglandin level was high on the first day of the menstrual cycle, and in this direction, it was considered appropriate to perform the pain assessment of nursing students with dysmenorrhea on the first day of the menstrual cycle [38].

In order to standardize the evaluation processes of the interventions (music and drawing) applied to the groups, participants were asked to draw a picture from the drawing group and listen to music from the music group until noon (12:00) at the latest. Considering that the menstrual periods of nursing students with dysmenorrhea will vary individually, weekly reminder messages were sent to the participants. In addition, daily messages were sent to each participant in the menstrual cycle to remind them to draw pictures and listen to music. Participants in the music and drawing groups were asked to make their assessments in the afternoon (after 12.00 pm) following the intervention and in the control group on the first day, when pain, menstrual symptoms, and perceived stress were felt most acutely. One researcher (BK) collected all of the data (Fig. 2).

Interventions

Music group

In the second and third months, when the effectiveness of the study was evaluated, female students were asked to listen to a song lasting 29 min and 32 s, which has been used in studies with a high level of evidence of effectiveness in the literature, with the help of headphones, for a total of four days, three days before menstruation and the first day of menstruation. The song, determined by examining the literature in the study, was composed by researcher Juan Sebastian Martin-Saavedra, and the author of the song was registered by the copyright institution under the name Occasio Adolore (Musical Piece No. 5-559-355 and Phonogram No. 12-105-295). While composing the song, the researcher aimed to create music that would reduce the pain and suffering felt by people, activate positive and positive emotions, and make the person feel at peace and relax. The song composed by the author is available online as part of the article published in the literature (https://soundcloud.com/jssmartin/occasio-adolore) [25]. Written permission was obtained from Juan Sebastian Martin-Saavedra to use the song in the study. The access link to the song was sent to the participants via social media (WhatsApp). After listening to the music for three days before the menstrual cycle and on the first day of menstruation (four days in total), pain, menstrual symptoms, and perceived stress on the first day of menstruation were measured using 100mmVAS of pain, MSS, and PSS, respectively. A total of 32 young female nursing students from the music group completed the study.

Drawing Group

In the second and third months, the participants were asked to draw pictures for four days (three days before menstruation and the first day of menstruation) for 29 min and 32 s (the duration of the intervention was

determined in parallel with the music group to avoid variability between the groups). The type of picture to be used in the drawing (dry pencil, crayon, or watercolor) was left to the availability of the participants, and they were instructed to prefer colors and drawings that would raise their emotions, focus their drawings, and nurture positive emotions. After drawing for three days before the menstrual cycle and on the first day of menstruation (four days in total), pain, menstrual symptoms, and perceived stress on the first day of menstruation were measured using 100mmVAS of pain, MSS, and PSS, respectively. A total of 32 young female nursing students from the drawing group completed the study.

Control group

Participants were measured on the first day of the menstrual cycle in the second and third months using 100mmVAS of pain, MSS, and PSS for pain, menstrual symptoms, and perceived stress, respectively. A total of 32 young female nursing students from the control group completed the study.

Outcome measures

The primary outcome of the study was the change from baseline and persistence of menstrual pain, menstrual symptoms, and perceived stress levels assessed by 100mmVAS of pain, MSS, and PSS, respectively. Assessments were performed at one month (no intervention), two months (first intervention), and three months (end of intervention). Secondary outcomes were the effects of pre-intervention socio-demographic and menstrual cycle characteristics on 100mmVAS of pain, MSS, and PSS.

Statistical analysis

The only change to the method after allocation concealment was regarding the statistical analysis. An intentionto-treat (ITT) analysis, which includes all participants as originally allocated regardless of adherence to the intervention, was not conducted in this study. Instead, we utilized a per-protocol analysis, focusing on the data from participants who completed the intervention according to the study protocol. Data were analyzed by double entry into SPSS (version 23.0, SPSS Inc. Chicago) and Software for Statistics and Data Science for Windows (STATA) (version 12, StataCorp, College Station, Texas, United States of America) statistical programs. The normal distribution of the data was determined using the Shapiro-Wilk normality test. As a result of the normality test, nonparametric tests (Kruskal Wallis test and Wilcoxon test) were applied for variables that did not show normal distribution, and parametric tests (One-way ANOVA and Paired Sample t-test) were applied for variables that showed normal distribution. If the measurements were greater than or equal to 2, variance analysis in repeated



Fig. 2 Study design

measures and Benforenni were used to determine which measurements caused the difference. Appropriate correlation analyses (Pearson or Spearman) were used to examine the relationships between variables. Generalized Linear Models were used to compare scale scores by group and time. All evaluations were performed with a 95% confidence interval, and p < .05 was accepted as the limit of statistical significance.

Ethical considerations

Ethical approval was obtained from Bartin University Social and Human Sciences Ethics Committee (date: 17.07.2023, number: 2023-SBB-0415), written permission was obtained from the Dean's Office of Bartin University Faculty of Health Sciences, where the study was conducted, and a written informed consent form was obtained from all female nursing students participating in the study. Written informed consent forms were obtained after all participants were explained about the purpose and process of the study. The study was conducted following the ethical standards in the Declaration of Helsinki. It is also registered at Clinicaltrials.gov (Clinical Trial registration number: NCT06027489).

Results

Comparison of socio-demographic and menstrual cycle characteristics of the groups

The socio-demographic characteristics of the participants are presented in Table 1. The mean age of the control group was 21.13 ± 1.93 , the mean BMI was 20.99 ± 2.70 ,

Table 1Participants' sociodemographic characteristics ($n = 96$)							
	Control		Music		Drawin	g	p
	group (n=32) Moan+SD		group		group		
			$\frac{(n=32)}{Moon+}$	(n=32)		50	
Δαρ 2113+193		02	20.04 L 0.84		Mean±SD		0.462
Age PMI	21.13±1	.95	20.94±0	2.04	20.71±0).01)) E	0.402
Divit	20.99±2	06	22.34 ± 3	%	22.11±3	0.2J 06	0.102
Family Structure		70		70		70	
Nuclear family	74	75.0	27	84.4	27	84.4	0 339
Extended family	8	25.0	5	15.6	5	15.6	0.557
Employment Status as a Student	0	20.0	5	15.0	5	15.0	
Working	2	6.3	0	0.0	1	3.1	0.475
Not working	- 30	93.8	32	100.0	31	96.9	0.175
Mother's Education Status					•		
Secondary Education	13	40.6	11	34.4	9	28.1	. 482
High School	14	43.8	15	46.9	15	46.9	
University and above	5	15.6	6	18.8	8	25.0	
Mother's Employment Status							
Working	5	15.6	5	15.6	5	15.6	1.000
Not working	27	84.4	27	84.4	27	84.4	
Father's Education Status							
High School	24	75.0	21	65.6	21	65.6	0.421
University	8	25.0	11	34.4	11	34.4	
Father's Employment Status							
Working	32	100.0	32	100.0	32	100.0	1.000
Place of Accommodation							
Dormitory	25	78.1	21	65.6	21	65.6	0.437
At home with friends	4	12.5	6	18.8	5	15.6	
At home with family	3	9.4	5	15.6	6	18.8	
Income Status							
Income less than expenditure	9	28.1	0	0.0	5	15.6	0.004
Income equal to expenditure	23	71.9	29	90.6	23	71.9	
Income more than expenditure	0	0.0	3	9.4	4	12.5	
Smoking Status							
Yes	7	21.9	5	15.6	10	31.3	0.375
No	25	78.1	27	84.4	22	68.8	
Personality Characteristics							
Introvert	3	9.4	0	0.0	1	3.1	0.404
Extrovert	8	25.0	6	18.8	6	18.8	
Logical	9	28.1	15	46.9	8	25.0	
Emotional	11	34.4	10	31.3	17	53.1	
Aggressive	1	3.1	1	3.1	0	0.0	

*Kruskall Wallis Test, **Mann Whiney U Test

Note n: Number, %: Percentage

93.8% were not working as students, and 34.4% had an emotional personality. The mean age of the music group was 20.94 ± 0.84 , the mean BMI was 22.34 ± 3.00 , 100.0% were not working as students, and 46.9% had a logical personality. In the drawing group, the mean age was 20.71 ± 0.81 , the mean BMI was 22.11 ± 3.25 , 96.9% were not working as students, and 53.1% were emotional. There was no statistically significant difference between the female students in the control and experimental groups regarding descriptive characteristics (p < .05). This result shows that the groups were similar.

The characteristics of the participants related to the menstrual cycle are presented in Table 2. In the control group, the mean age at menarche was 13.41 ± 1.54 ; the

mean menstrual cycle duration was 5.59 ± 1.19 ; 75.0% had a family member with dysmenorrhea, and 81.3% used complementary and alternative treatment methods to alleviate dysmenorrhea. In the music group, the mean age at menarche was 12.81 ± 1.26 ; the mean menstrual cycle duration was 5.56 ± 1.16 ; 71.9% had a family member with dysmenorrhea, and 87.5% used complementary and alternative treatment methods to alleviate dysmenorrhea. In the drawing group, the mean age at menarche was 13.31 ± 1.23 ; the mean menstrual cycle duration was 5.66 ± 1.29 ; 71.9% had a family member with dysmenorrhea, and 96.9% used complementary and alternative treatment methods to alleviate dysmenorrhea, and 96.9% used complementary and alternative treatment methods to alleviate dysmenorrhea. There was a statistically significant difference between the

Table 2 Participants' menstrual cycle-related characteris	stics (<i>n</i> = 96)					
	Contro group (n=32	ol ' 2)	Music group (n = 32	2)	Drawi group (n = 32	ng	p
	$\frac{(n-s_2)}{Ort\pm SS}$		$ \frac{(1 + 22)}{\text{Ort} \pm SS}$		Ort±SS		
Age at menarche (years)	13.41±	±1.54	12.81	±1.26	13.31 ±	1.23	0.173
Duration of menstrual cycle (days)	5.59±	1.19	5.56±	1.16	5.66±	1.29	0.952
	n	%	n	%	n	%	
Response to waiting for menstruation before the menstrua	l cycle						
l welcome it naturally	13	40.6	9	28.1	8	25.0	0.260
l like	1	3.1	0	0.0	1	3.1	
l don't like it	16	50.0	21	65.6	18	56.3	
l hate it	2	6.3	2	6.3	5	15.6	
Presence of a family member with dysmenorrhea							
Yes	24	75.0	23	71.9	23	71.9	0.780
No	8	25.0	9	28.1	9	28.1	
Who is the person in the family with dysmenorrhea							
Mother	13	54.2	11	47.8	13	56.5	0.785
Sister (older)	8	33.3	8	34.8	7	30.4	
Sister (younger)	3	12.5	3	13.0	3	13.0	
Cousin/niece	0	0.0	1	4.3	0	0.0	
Use of complementary and alternative treatment methods	(massage, l	herbs, exerci	se, etc.) to a	alleviate dys	menorrhea		
Yes	26	81.3	28	87.5	31	96.9	0.145
No	6	18.8	4	12.5	1	3.1	
If using complementary and alternative treatment method	s (massage	, herbs, exer	cise, etc.) to	alleviate dy	smenorrhe	a, status of n	nedical
treatment use							
In addition to medical treatment	9	34.6	17	60.7	11	35.5	0.184
Only complementary and alternative treatment methods	17	65.4	11	39.3	20	64.5	
Information sources on complementary and alternative tre	atment me	thods used i	n dysmend	orrhea			
Friend	7	21.9	25	78.1	22	68.8	0.000
Physician	7	21.9	3	9.4	0	0.0	
Nurse	23	71.9	16	50.0	5	15.6	
Herbalist	0	0.0	2	6.3	0	0.0	
Internet	20	62.5	13	40.6	29	73.8	
Family	3	9.4	1	3.1	2	6.3	
Willingness to consult/get information from health person	nel about c	omplementa	ary and alte	ernative ther	apies		
Yes	27	84.4	28	87.5	24	75.0	0.399
No	5	15.6	4	12.5	8	25.0	

*Kruskall Wallis Test, **Mann Whiney U Test

Note n: Number, %: Percentage

socio-demographic characteristics of the groups only in the source of information about complementary and alternative treatment methods used in dysmenorrhea (p < .05).

Effects of music and drawing on Pain intensity, menstrual symptoms, and perceived stress in Dysmenorrhea

The study shows the difference between intra- and intergroup 100mmVAS of pain, PSS, MSS and subscale mean scores in Tables 3 and 4; Fig. 3. Within the control group, a significant difference was found in the second-month 100mmVAS of pain, PSS, MSS, and sub-dimension mean scores compared to the pre-test and first-month mean scores. Within the music and drawing groups, a significant difference was found in the second-month 100mmVAS of pain, PSS, MSS, and sub-dimension mean scores compared to the pre-test and first-month mean scores and in the first-month 100mmVAS of pain, PSS, and MSS mean scores compared to the pre-test mean scores. A statistically significant difference between the groups was found between the first and second-month 100mmVAS of pain, PSS, MSS, and subscale mean scores (p < .000). In the regression analysis, listening to music and drawing pictures showed a statistically significant positive effect at month 1, and this effect was found to be stronger at month 2 follow-up (Table 4).

The relationship between pain, menstrual symptoms, and perceived stress

The relationship between the 100mmVAS of pain, PSS, and MSS of the groups in the study is presented in Table 5. A statistically significant relationship was found between the 100mmVAS of pain, PSS and MSS of the music and drawing groups (music group p<.000, r=.794; p<.000, r=.821; p<.000, r=.745; drawing group p<.000, r=.805; p<.000, r=.693; p<.000, r=.793, respectively) and the 100mmVAS of pain and MSS of the control group (p<.011, r=.442).

Discussion

This is the first study that evaluates the effects of listening to music and drawing in coping with the complaints of nursing students experiencing dysmenorrhea. In the study, it was found that both art and music practice significantly reduced menstrual pain, perceived stress, and menstrual symptoms in nursing students with dysmenorrhea. On the other hand, music practice yielded better results in menstrual symptoms and perceived stress variables than drawing practice in nursing students with dysmenorrhea. These effects are supported by physiological responses, such as the modulation of the autonomic nervous system, which may explain the observed improvements in coping with dysmenorrhea.

The present study found that the mean menstrual pain of the young women in the music group decreased significantly after the intervention. In addition, the levels of menstrual pain experienced by female students who listened to music were also found to be lower compared to the control group. Therefore, it can be said that listening to music is effective for lowering menstrual pain due to dysmenorrhea. In this study, music composed by Juan Sebastian and Martin-Saavedra was used. In Martin-Saavedra and Ruiz-Sternberg's (2020) study with women with dysmenorrhea, it was reported that women in the music group had significantly lower pain levels after the application [25]. Similarly, in a randomized controlled trial in which Selçuk and Baysal (2022) used the same music, it was found that the pain levels of women with dysmenorrhea in the music group were significantly reduced [21]. Previous studies conducted in different countries reported that listening to music effectively reduced menstrual pain due to dysmenorrhea [19, 39]. In randomized control studies comparing listening to music with other non-pharmacological methods, listening to music was found to be more effective than deep breathing exercise, guided imagery, jogging, dysmenorrhea exercise, massage therapy [40–42]. In the study comparing Gym Ball Exercise with music therapy, no difference was found between women with dysmenorrhea [43]. On the other hand, although there is no study comparing listening to music with drawing pictures of women with dysmenorrhea, it is thought that the results of this study will contribute to the literature. The use of a randomized controlled trial design enhances the reliability of the results by minimizing selection bias and controlling for confounding variables. This methodological strength likely contributed to the observed significant effects of music on menstrual pain. As demonstrated in similar randomized controlled trials, such as those by Selçuk and Baysal (2022) and Monajemi (2017) the application of this rigorous design has consistently yielded robust findings and supported the efficacy of non-pharmacological interventions in managing menstrual pain. By employing a similar methodological approach, this study aligns with and builds upon existing evidence, reinforcing the validity of the observed outcomes. This study used consistent and specific interventions (music composed by Juan Sebastian and Martin-Saavedra and drawing practice), allowing for clear comparisons. This consistency is crucial as it helps isolate the effects of each intervention from other variables.

The present study found that the mean perceived stress of the young women in the music group decreased significantly after the intervention. This result suggests that physiological arousal has an effect on music's stress reduction. Physiological arousal is based on dopaminergic synapses in hypothalamic pathways, mediated by

Table 3 Difference be	tween intragroup and intergro	up 100mmVAS of pain, PSS, MS	S, and subscale mean scores (n	=96)
Scales	Control	Music	Drawing	Test
	group	group	group	
	<u>(n=32)</u>	(n=32)	(n=32)	
	Mean ± SD	Mean ± SD	Mean ± SD	
Visual Analog Scale (10	0mmVAS of pain)			
Pre-test	7.16±1.99 ^{a,1}	7.22±1.64 ^{b,1}	6.69±1.80 ^{c,1}	0.444 .818 ^F
1. 1st month	7.16±1.99 ^{a,2}	4.84±1.80 ^{b,2}	5.09±1.55 ^{c,2}	0.000 16.131 ^F b>a.c>a
2. 2nd month	7.50±1.98 ^{a,3}	2.13±1.45 ^{b,3}	2.91±1.33 ^{c,3}	0.000 103.623 ^F b>a,c>a
Test	0.001*	0.000*	0.000*	,
	1<3	3<2<1	3<2<1	
Perceived Stress Scale (I	PSS)			
Pre-test	28.75±3.71 ^{a,1}	29.91 ± 3.98 ^{b,1}	27.38±3.63 ^{c,1}	0.031 3.603 ^F b>c
1. 1st month	29.09±3.87 ^{a,2}	14.06±4.06 ^{b,2}	18.13±5.60 ^{c,2}	0.000 92.266 ^F a>c>b
2. 2nd month	30.03±4.16 ^{a,3}	3.59±3.82 ^{b,3}	8.34±5.46 ^{c3}	0.000 308.875 ^F a>c>b
Test	< 0.05*	0.000*	0.000*	
	1<2<3	3<2<1	3<2<1	
Menstrual Symptom Sca	ale (MSS)			
Pre-test	79.25 ± 15.41 ^{a,1}	85.41 ± 10.77 ^{b,1}	80.69±11.07 ^{c,1}	0.129 2.093 ^F
1. 1st month	88.00 ± 20.08 ^{a,2}	62.41 ± 15.23 ^{b,2}	65.53±15.37 ^{c,2}	0.000 21.474 ^F b>a.c>a
2. 2nd month	90.66±19.13 ^{a,3}	34.00±12.62 ^{b,3}	47.31±15.11 ^{c,3}	0.000 111.828 ^F a>c>b
Test	<0.05*	0.000*	0.000*	
	1<2<3	3<2<1	3<2<1	
MSS - Negative effects/s	somatic complaints			
Pre-test	44.41 ± 9.30 ^{a,1}	49.47±6.67 ^{b,1}	45.66±7.22 ^{c,1}	0.030 3.646 ^F b > a
1. 1st month	47.97±11.26 ^{a,2}	37.31 ± 9.90 ^{b,2}	37.56±9.45 ^{c2}	0.000 11.303 ^F b>a.c>a
2. 2nd month	$49.31 \pm 10.60^{a,3}$	19.13±7.56 ^{b,3}	26.66±9.28 ^{c,3}	0.000 92.797 ^F
Test	<0.05*	0.000*	0.000*	47070
	1<2<3	3<2<1	3<2<1	
MSS - Symptoms of mer	nstrual pain			
Pre-test	17.91 ± 3.44 ^{a,1}	18.72±3.06 ^{b,1}	17.69±3.34 ^{c,1}	0.420 877 ^F
1. 1st month	20.97 ± 5.39 ^{a,2}	13.25±3.23 ^{b,2}	14.28±3.59 ^{c,2}	0.000 32.271 ^F
2. 2nd month	21.72 ± 5.22 ^{a,3}	7.63±2.23 ^{b,3}	$10.63 \pm 3.34^{-c,3}$	b>a, c>a 0.000 122.094 ^F a>c>b

Table 3 (continued)

Control	Music	Drawing	Test
group	group	group	
(n = 32)	(<i>n</i> =32)	(n=32)	
Mean ± SD	Mean ± SD	Mean ± SD	
< 0.05*	0.000*	0.000*	
1<2<3	3<2<1	3<2<1	
16.94±4.15 ^{a,1}	17.22 ± 3.85 ^{b,1}	17.34±3.52 ^{c,1}	0.911
			.094 ^F
19.06±4.52 ^{a,2}	11.84±3.66 ^{b,2}	13.69±4.08 ^{c,2}	0.000
			26.716 ^F
			b>a,c>a
19.63 ± 4.35 ^{a,3}	7.25 ± 3.77 ^{b,3}	10.03 ± 3.78 ^{c,3}	0.000
			85.310 ^F
			a>c>b
<0.05*	0.000*	0.000*	
1<2<3	3<2<1	3<2<1	
	Control group (n=32) Mean±SD <0.05* 1<2<3 16.94±4.15 ^{a,1} 19.06±4.52 ^{a,2} 19.63±4.35 ^{a,3} <0.05* 1<2<3	ControlMusicgroupgroup $(n=32)$ $(n=32)$ Mean ± SDMean ± SD<0.05*	ControlMusicDrawinggroupgroupgroup $(n=32)$ $(n=32)$ Mean±SDMean±SDMean±SD<0.05*

^F One-way variance analysis(ANOVA)

*Variance analysis in repeated measures- Benforenni

Table 4	Effects of	f listening to	music and	l drawing (on pain,	menstrual	symptoms and	perceived	stress
							/ /		

Variable	В	Std error	Beta	95% Cl	<i>p</i> value
Constant	2.587	0.153		2.282-2.891	0.000
100mmVAS of pain	-0.047	0.011	-0.708	-0.0700.024	0.000
MSS	0.006	0.005	0.196	-0.0840.016	0.000
PSS	-0.060	0.047	-0.209	-0.0560.008	0.000
R: 0.724; R ² : 0.525; F: 33.874,					

*Lineer regression

activation of the sympathetic nervous system. Music can affect brain function through modulation of dopaminergic activity within the reward circuit, which associates dopamine release with intense musical pleasure [31]. Even if there is not yet definitive evidence on the role of intrinsic qualities of music in this context, there are some music-specific features, such as pitch centrality, that are associated with specific responses of the reward system, as in the case of out-of-tune notes in a tonal melody [31, 44]. This means that music may act as a mediator through the autonomic nervous system, able to influence physiological responses such as heart rate, blood pressure, respiratory rate, body temperature, skin conductance and muscle tension. This is mediated in part through noradrenergic neurons that regulate cholinergic and dopaminergic neurotransmission [45, 46]. Such physiological responses affect the listener's mood and motivation by enhancing dopaminergic activity within reward circuits, which can further reward and motivate listeners [46, 47]. Similarly, in a randomized controlled study conducted by Kırca & Kızılkaya (2022) to investigate the effect of music therapy on premenstrual symptoms, it was reported that the music group reduced anxiety scores after the intervention [48]. Zadbagher Seighalani et al. (2021) also found that music intervention was effective in reducing anxiety levels in women with premenstrual syndromes in their randomized controlled trial [49]. Similar results have been shown in other randomized controlled studies [21, 39]. The results of the study are parallel to the literature, which is thought to be due to research designs, sample size, measurement tools and context, and it can be said that listening to music reduces the perceived stress level in women with dysmenorrhea. On the other hand, it was found that listening to music gave significantly better results compared to the drawing group. This result is thought to make a new contribution to the literature.

The present study found that the mean menstrual symptoms of the young women in the music group decreased significantly after the intervention. In other randomized controlled studies in which music intervention was applied, menstrual symptom levels of women in the music group were found to be lower after the intervention [39, 40, 43]. In these studies, classical music and their choice were used, and it was also seen that similar results were obtained with this study in which music composed by Juan Sebastian and Martin-Saavedra was used [25]. On the other hand, in this study, women's somatic complaints related to menstrual symptoms, menstrual pain symptoms, and coping methods decreased significantly after the interventions. This significant



Fig. 3 Change in mean 100 mm VAS pain, PSS, and MSS scores of the groups over time

Table 5	The relationshi	p between VAS,	PSS, and MSS of	of the groups

Scales		Control group (n=32)		Music group (n=32)			Drawing group (n=32)			
		1	2	3	1	2	3	1	2	3
Visual Analog Scale for Pain(VAS) (1)	p r	-	0.632 0.088*	0.442 0.011*	-	0.000 0.794*	0.000 0.821*	-	0.000 0.805*	0.000 0.693*
Perceived Stress Scale (PSS) (2)	p r	-	-	0.167 0.360*	-	-	0.000 0.745*	-	-	0.000 0.793*
Menstrual Symptom Scale (MSS) (3)	p r	-	-	-	-	-	-	-	-	-

*Pearson Correlation

decrease shows that listening to music is more effective than drawing intervention in reducing menstrual symptom levels. Although there are no similar studies in the literature, it is thought that the results of the study will make a new contribution. The present study found that the mean menstrual pain, perceived stress, and menstrual symptom levels of the young women in the drawing group decreased significantly after the intervention. However, the menstrual pain levels of the women in the drawing group after the intervention were found to be lower compared to the control group. Therefore, it can be argued that drawing practices are effective for menstrual pain due to dysmenorrhea. The music group was superior to the drawing group in reducing perceived stress and menstrual symptom levels. Although there are no similar studies evaluating the effectiveness of drawing in women with dysmenorrhea in the literature, various studies are conducted with different sample groups [34, 50, 51]. In the systematic review study by Kievisiene et al. (2020) comparing Art Therapy and Music Therapy in patients with breast cancer, it was reported that both interventions reduced pain and anxiety [52]. In their study with adult women, Abbing et al. (2019) found that drawing pictures reduced anxiety symptoms, improving quality of life and aspects of emotion regulation [53]. Oh & Chung (2021) reported that art therapy positively affected the psychological, social, and disease states of children with Crohn's disease in their study with children with Chrons' disease [50]. In the systematic review study of Abbing et al. (2018) covering the years 1997-2017 to evaluate the effect of art therapy on anxiety in adults, it was emphasized that art therapy is beneficial in reducing anxiety and stress; however, the evidence is insufficient [53]. As a result, there have been many studies investigating the effectiveness of art therapy on pain and anxiety in various sample groups; however, more data are needed to determine the effects of art therapy on pain, perceived stress, and menstrual symptoms in women with dysmenorrhea. The sample size and demographic characteristics of nursing students in this study may influence the generalizability of the results. Future research should consider including a more diverse sample to validate the findings across different populations. Differences in the duration and frequency of interventions (drawing and listening and to a song lasting 29 min and 32 s/four days in this study) between this study and previous research could account for variations in outcomes. Further studies should standardize these parameters to enable more accurate comparisons.

Strength and limitations

This study has a few limitations and strengths. The longterm effects of the interventions in the study were not monitored; therefore, follow-up data collection is recommended in future studies. This randomized controlled trial is limited in that it does not fully meet the MAX-MIN-CON rule for randomized controlled trials (RCTs), despite the use of detailed control measures, monitoring, and compliance, and statistical analyses. Although the nursing students included in the study met the inclusion criteria and were similar in terms of sociodemographic and menstrual cycle characteristics between the groups, one of the limitations was that situations that could affect their lives, such as psychological variables, were not evaluated during the follow-up period. Conducting the study in a single center is another limitation; however, the fact that this university is a well-established and successful university in the region and that students with different socio-demographic characteristics from the surrounding provinces are studying constitutes the study's strength. In addition, another strength of the study is that it is the first randomized, controlled, double-blind study evaluating the effectiveness of listening to music and drawing pictures in coping with dysmenorrhea complaints in nursing students with dysmenorrhea.

Conclusion

In summary, both listening to music and drawing had a significant effect on reducing menstrual pain intensity, perceived stress, and menstrual symptom levels in coping with dysmenorrhea complaints of nursing students experiencing dysmenorrhea. However, listening to music showed better results in reducing perceived stress and menstrual symptom levels than drawing. Therefore, it can be concluded that listening to music and drawing pictures is an effective, easy to apply and inexpensive method to cope with complaints of dysmenorrhea. However, studies with large sample groups and long-term follow-up are needed.

Abbreviations

100mmVAS of pain	Visual Analog Scale
PSS	Perceived Stress Scale
MSS	Menstrual Symptoms Scale
PD	Primary dysmenorrhea
SD	Secondary dysmenorrhea

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12905-024-03398-0.

Supplementary Material 1

Acknowledgements

We are grateful to all patients who nursing students in this trial.

Author contributions

Burcu Küçükkaya and Şükran Başgöl developed the study design. Burcu Küçükkaya and Şükran Başgöl were responsible for patient recruitment and data collection. Burcu Küçükkaya processed the data and performed data analyses. Burcu Küçükkaya and Şükran Başgöl interpreted the data. Burcu Kucukkaya wrote the first draft of the manuscript with support of Şükran Başgöl. All authors critically reviewed and approved the final draft of the manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability

Data and syntaxes supporting research findings are available to the corresponding author upon reasonable request. Data is not publicly available due to privacy and ethical restrictions.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from Bartin University Social and Human Sciences Ethics Committee (date: 17.07.2022, number: 2023-SBB-0415), written permission was obtained from the Dean's Office of Bartin University Faculty of Health Sciences, where the study was conducted, and a written informed consent form was obtained from all female nursing students participating in the study. Written informed consent forms were obtained after all participants were explained about the purpose and process of the study. The study was conducted following the ethical standards in the Declaration of Helsinki. The randomized controlled trial was registered with Clinical Trials under registration number NCT06027489. No harm or unintended effects were reported as a result of the interventions implemented by the students participating in this study to their groups.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 9 April 2024 / Accepted: 30 September 2024 Published online: 25 October 2024

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