Journal Pre-proof

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PII: S0965-2299(21)00005-4

DOI: https://doi.org/10.1016/j.ctim.2021.102664

Reference: YCTIM 102664

To appear in: *Complementary Therapies in Medicine*

Received Date: 12 September 2019

Revised Date: 28 December 2020

Accepted Date: 12 January 2021

Please cite this article as: Gurbuz- Dogan R, Ali A, Candy B, King M, The effectiveness of Sufi music for mental health outcomes. A systematic review and meta-analysis of 21 randomised trials, *Complementary Therapies in Medicine* (2021), doi: https://doi.org/10.1016/j.ctim.2021.102664

The effectiveness of Sufi music for mental health outcomes. A systematic review and meta-analysis of 21 randomised trials.

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Highlights

- Twenty-one randomised clinical studies were included in the systematic review.
- The meta-analysis showed that Sufi music therapy reduced symptoms of state anxiety.
- There was a high level of heterogeneity among studies in the meta-analysis.
- The evidence of Sufi music's effect on anxiety was rated as very low.
- Sufi music may reduce depression, clinical symptoms of schizophrenia, and stress.

Abstract

Background: There is some evidence that Sufi music therapy might improve physical and mental well-being; however, no systematic review or meta-analysis has pooled and critiqued the evidence. The aim of this systematic review was to evaluate the effects of Sufi music therapy on mental health outcomes.

Methods: We searched Medline, PsycINFO, the Web of Science, Science Direct, PsycARTICLES, Cochrane Library, SCOPUS, CINAHL Plus, AMED, and ULAKBIM databases, and the reference lists of the studies found. Papers published in academic peer-reviewed journals were included, as well as from other sources such as chapters in edited books, the grey literature, or conference presentations. Articles published up to March 2020 in Turkish and English were included. Our primary outcome of interest was anxiety and secondary outcomes of interest were other mental health outcomes such as depression. To assess the methodological quality of the articles, the *Cochrane Risk of Bias Tool* was used. The quality of evidence was assessed using the GRADEpro GDT system.

Results: This search yielded 21 clinical trials that were eligible for inclusion. A meta-analysis, using a random effects model, of 18 randomised controlled trials involving 1454 participants showed that Sufi music therapy with makams, compared with treatment as usual (TAU) or a no-music control group, reduced symptoms of anxiety in the short term in patients undergoing an operation or treatments such as chemotherapy or haemodialysis (standardised mean difference SMD= -1.15, 95% CI, -1.64 to -0.65; very low-quality evidence). The evidence of Sufi music with makam's effect on anxiety is rated as very low. Qualitative synthesis of secondary outcomes revealed significant effects for depression, positive symptoms in schizophrenia, stress, which however were based on fewer studies. Trials were of moderate methodological quality, and there was significant heterogeneity across the studies.

Conclusion: Sufi music may reduce anxiety of patients undergoing medical procedures like haemodialysis, coronary artery surgery, angiography, colonoscopy, bone marrow aspiration and biopsy procedures. Evidence from single studies suggests effects on depression and stress as well. However, due to methodological limitations of the studies, further, higher quality studies are required in other cultures.

List of abbreviations

SMD; Standardised mean difference

RCT/s; Randomized controlled trial/s

M; means

SD; standard deviations

RR; relative risk

CI; confidence intervals

STAI; State-Trait Anxiety Inventory

HAM-A; Hamilton Anxiety Scale

BAI; Beck Anxiety Inventory

GDS; Geriatric Depression Scale

HSS; Haemodialysis Stressor Scale

1. Keywords

Music therapy, meta-analysis, spiritual music, Sufi music, makam, makam music therapy, anxiety, systematic review, mental health, mental disorder.

2. Background

Music has been used as a way to help heal illness throughout history (Biley, 1999). In recent decades, there has been an increasing interest in the therapeutic potential of music (Aldridge, 1993), particularly because of its safe, economic and potentially effective nature (Ovayolu et al., 2006). Previous systematic reviews indicate that either therapeutic music or simply listening to music, may have a positive effect on symptoms of anxiety (Bradt, Dileo, and Potvin, 2013), including pre-postoperative anxiety (Hole, Hirsch, Ball and Meads, 2015; Graff, Cai, Badiola, and Elkassaany, 2019) and may also improve symptoms of depression (Maratos, Gold, Wans, and Crawford, 2013), dementia (Ueda, Suzukamo, Sato, and Izumi, 2013) and schizophrenia (Geretsegger et al., 2017). Although these reviews provide an evidence base for music's place in mental health, there is a need for further, higher quality studies, including studies investigating a range of types of music.

The Sufi tradition has valued and used music in a way that is different to most Muslim communities. For example, Trimingham (1971) reports that although music does not have a place in Islamic rituals and Muslims' daily life, music plays a significant role for Sufis in rituals and daily experiences. As a Muslim community that has enriched its culture with Sufi traditions, Turkish people have been using music therapy over many centuries. Thus, they might offer a unique theory of music therapy to the world (Benek, Sakar, Gumustekin, and Bayram, 2015). Turkish music using makams played with Sufi instruments (coupled with the sounds of water running in a fountain) was used to treat mentally ill patients throughout the Seljukian Dynasty and

Ottoman Empire Age (from the 11th to 18th century), with the earliest accounts of music therapy in Turkish mental hospitals dating back even earlier to the 9th century (Giray, 2008).

The main feature of this music therapy is its makam nature. In Anatolia and the Middle East, it was believed that there was a relationship between particular makams and their effects on specific illnesses at particular times of the day. A makam has been defined by Ederer (2011: xxvi) as "a kind of melodic mode; a subset of rules regarding the choice of permissibly playable tones and a player's treatment of them." This is in terms of melodic direction, order of importance regarding emphasis and tonal inflexion. Makams are drawn from a larger scale of acceptable tones in order to create a distinct modal identity. Over 600 makams have been identified, although some of them have become obsolete (Sagun and Bolat, 2016). Using music with makams for therapeutic purposes might inform theories about western music therapy and allow therapists to apply these theories in other parts of the world.

Many scholars of makam music theory have had an interest in Sufism, and thus makam theory has grown in the hands of Sufis and flourished in Sufi centres. Although a number of studies have reported on the application of Turkish music therapy in mental health (Benek et al., 2015; Erdal and Erbas, 2013; Tanriover, 2010), no systematic review or meta-analysis has been undertaken.

3. Methods

3.1. Aim

The aim of this study was to perform a systematic review and if appropriate a meta-analysis of experimental studies including randomised controlled trials (RCTs) to evaluate the effects of Sufi music therapy with makams on mental health.

3.2. Eligibility Criteria

3.2.1. Inclusion Criteria

The main criterion for inclusion of articles in the review was that the study had examined the effects of Sufi music therapy with makams on mental health outcomes. Studies which used Sufi music therapy with makams alongside other therapy methods like cognitive behaviour therapy or dance/art therapy were also included. The studies included the following: (1) Population: individuals (adults and/or children) with any mental health problem, except substance dependence and based on diagnosis or self-report. (2) Intervention: music therapy with makams, defined as a) listening to music which has at least one specific makam (however it is described by the author) that is regarded as therapeutic or b) listening to Turkish classical music or Sufi instrumental music which has at least a makam (however described by the author) but the type of makam is not stated; (3) Outcomes: changes in any measures of mental health. Studies examining effects on physical health outcomes were also included if they contained at least one mental health outcome; and (4) Study type: Randomised controlled studies using any type of control (e.g. treatment as usual). Our ultimate aim was to consider only evidence from RCTs if there were enough to justify this approach. However, at the outset, inclusion criteria on study design were broad to ensure we had sufficient evidence on the state of research in this field.

3.2.2. Exclusion Criteria

Studies which dealt solely with other types of music therapies (rather than Sufi music therapy with makams), such as religious or other secular music in the therapy were excluded.

3.3. Primary Outcomes

With a view to possible meta-analyses, we aimed to group the studies found as follows. Anxiety was the primary outcome of this review, and other mental health outcomes such as depression were included as secondary outcomes. In terms of structure, we divided the studies into those 1) of a single application of the intervention with immediate outcome measurement and 2) interventions with more than one session of music and later time follow-up points.

3.4. Search Strategy

In order to identify relevant articles, a search of the following databases was conducted in July 2017 and March 2020: MedLine, PsycINFO, the Web of Science, Science Direct, PyscArticle, Cochrane Library, SCOPUS, CINAHL Plus, AMED, and ULAKBIM databases. Search terms relating to music therapy and mental health outcomes were combined using "and" and included the following: *intervention terms*; Sufi Music, music therapy, spiritual music, Islam, Sufism, Islamic Mysticism, Turkish makam/s, Turkish music, Turkish tunes, tasavvuf, Turkish music, music, Sufi, Turk; and *outcome terms*; mental health, psychiatric disorder, mental illness, stress, anxiety, depression, PTSD, trauma, intervention, mental well-being, depressive symptoms, mood. Papers published in academic peer-reviewed journals were included, as well as other sources such as chapters in edited books, the grey literature, or conference presentations. Articles published until March 2020 in Turkish and English were included. The reference sections of included articles were searched in order to identify additional studies.

The search results were screened, and duplicates were removed. Potentially relevant citations were identified by reviewing the titles and abstracts. Where citations appeared relevant, the full-text articles were retrieved, read in full and included in the

review according to the eligibility criteria. The study selection process was carried out independently by three reviewers (RNGD, AA and MC). If there were disagreements between two reviewers, they were reviewed and discussed with the other authors to seek resolution.

3.5. Risk of Bias

The risk of bias was assessed according to the Cochrane guidelines for clinical trials. To assess the methodological quality of the articles the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins and Green, 2011) was used, and each article was assessed for selection, performance, detection, attrition and reporting bias (see Table 2 for full assessment).

3.6. Data Extraction and Analysis

For each eligible study details of the study design, along with demographic and clinical details, were extracted. If insufficient data were available, we attempted to contact the authors of the research paper. For outcomes reported as continuous, the means (m) and standard deviations (SD) at follow-up were extracted or generated. For dichotomous outcomes, the relative risk (RR) and confidence intervals (CI) at follow-up were extracted or generated.

For trials that assessed anxiety, we considered if appropriate to pool their outcome data to analyse in Review Manager 5.3 using a random effects model as reviewers assumed that there is likely to be some variability between trials. For this purpose, continuous outcomes standardised mean differences (SMDs) between trial arms were used to report outcome measures. The weighting of the studies in the meta-analyses depended on the confidence interval; the wider the confidence interval in comparison to other trials included, the less weight was given to a study. Evaluation of the effect

sizes was conducted according to Cohen's criteria (Cohen, 1988), where an effect size of 0.2 was considered small, an effect size of 0.5 medium and an effect size of 0.8 was considered large.

We assessed statistical heterogeneity across the studies using the I^2 statistic, which measures the degree of inconsistency among the results of included studies and describes the proportion of variation among studies that is due to heterogeneity rather than chance (Higgins et al., 2003). An I^2 value of 0% to 40% was considered as not important or small, 30% to 60% as moderate, 50% to 90% as substantial, and 75% to 100% as considerable heterogeneity. We undertook appropriate subgroup analyses when we found substantial and/or considerable heterogeneity across studies.

Where a meta-analysis was possible, and if there were sufficient studies, a sensitivity analysis was undertaken whereby low-quality studies were removed, and the meta-analysis re-runs without these studies. The results of studies examining other outcomes, such as depression, were also explored. Subgroup analyses were performed for four sub-groups in our analysis: studies that measured Sufi music therapy with makams' effects on anxiety, studies that measured other mental health outcomes, studies taking measurements at the end of a single therapy and studies taking measurements after repeated interventions.

3.7. Quality of the evidence

The quality of evidence was assessed using the GRADEpro GDT system, which was developed by the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) Working Group. The GRADE system assesses the quality of the evidence in terms of five factors: methodological quality (risk of bias), the directness

of evidence, unexplained heterogeneity or inconsistency of results (including problems with subgroup analyses), imprecision of the results (wide confidence intervals) and risk of publication bias for each individual outcome (Schünemann et al., 2017).

The GRADE system uses the following criteria for assigning the quality of evidence;

• High: we are very confident that the true effect lies close to that of the estimate of the effect.

• Moderate: we are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of effect, but there is a possibility that it is substantially different.

• Low: our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.

• Very low: we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect (Atkins et al., 2004).

The grade rating system for evidence derived from a randomised control trial(s) starts as high. We decreased this rating by one (-1) or two (-2) (up to a maximum of -3 to 'very low') according to following;

-serious (-1) or very serious (-2) limitation to methodological quality of the study (based on the risk of bias assessment)

-high level of inconsistency of direction of results across the studies (-1)

-some (-1) or major (-2) indirectness of the evidence (e.g. studies of mixed populations where only 50% of the sample fulfilled inclusion criteria)

-imprecision of the results (-1) (e.g. wide confidence levels)

-high possibility of publication bias (-1).

4. Results

4.1. Selection

The initial search was run in 2017, and an updated search was done in 2020 for the new studies published between 2017-2020. After removing duplicates (1,955) from the initial database search (5,908) in 2017, 3,953 references were examined by reviewing the titles/ abstracts. In the update search in 2020, the titles/abstracts of 299 references were reviewed after removing duplicates (122) from the database search. A hundred sixty-three studies were considered potentially relevant, and their full texts were reviewed in depth (see Figure 1). Eleven further studies were identified as possibly relevant from the reference lists of these 163 publications. Thus, overall 174 studies' full texts were analysed. Ninety-seven articles were identified as descriptive studies and excluded from the review. A further 22 articles were excluded as their music therapy intervention did not include makams or Sufi Music and 15 papers were excluded because the outcomes of studies were not related to mental health. In addition, given that we had found sufficient randomised trials, we also decided to exclude from the analysis 14 papers that were not experimental studies and five that were not randomised trials.

After this selection process, 21 studies remained that met the final eligibility criteria and were included in this review (Aktas and Karabulut, 2019; Bekiroglu, Ovayolu, Ergun, and Ekerbicer, 2013; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Cinar, Olgun, Duran, and Arat, 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Ergin, Midilli, and Baysal, 2018; Inangil, Vural,

Dogan and Korpe, 2020; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir, Tasci, Yildizhan, Aslan and Eser, 2019; Parlar Kilic et al., 2015; Pinar and Tel, 2019; Sezer, 2012; Surucu, Ozturk, Vurgec, Alan and Akbas, 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Ugur, Yaman Aktas, Orak, Saglambilen, and Aydin Avci, 2016; Zengin et al., 2013). All were randomised controlled trials.

4.2. Study Characteristics

The 21 included studies were conducted between 2005 and 2019 in Turkey (Table 1). The sample sizes ranged from 14 to 200 (mean= 84), and the age of participants ranged from 18 to 89 years. All the studies recruited men and women, apart from three studies (Kocabas and Khorshid, 2012; Surucu et al., 2018; Toker and Komurcu, 2017) that included only women. All studies used Sufi music therapy with a makam or range of makams as an intervention. Twenty studies were written in English and one in Turkish (Cinar et al., 2016). Participants in all studies diagnosed with pre-opertaive or intraoperative anxiety apart from six studies where the participants diagnosed with depression (Ugur et al., 2016), anger (Sezer, 2012), schizophrenia (Pinar and Tel, 2019), test anxiety (Inangil, Vural, Dogan and Korpe, 2020), and generalised anxiety disorder (Bekiroglu et al., 2013; Ergin and Yucel, 2019). More descriptive information on the included studies is presented in Table 1.

4.3. Interventions

All studies used only listening to Sufi music with makam/s as an intervention. Although makams differed among them, 16 of the studies used specific makam/s as an intervention (Bekiroglu et al., 2013; Cantekin and Tan, 2013; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Ergin, Midilli, and Baysal, 2018; Inangil, Vural, Dogan and Korpe, 2020; Kocabas and

Khorshid, 2012; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Pinar and Tel, 2019; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013). One of the interventions used Turkish music with unspecified makams (Cigerci and Ozbayir, 2016), while four were described as Sufi music, also with unspecified makams (Aktas and Karabulut, 2019; Ovayolu et al., 2006; Sezer, 2012; Ugur et al., 2016). The specified makams used in the studies were as follows; both nihavend and buselik makam in two studies (Bekiroglu et al., 2013; Toker and Komurcu, 2017); only nihavend makam in two studies (Ergin and Yucel, 2019; Kocabas and Khorshid, 2012); rast and usak makam in one study (Cantekin and Tan, 2013); only rast makam in one study (Pinar and Tel, 2019); only usak makam in one study (Cinar et al., 2016); huseyni makam in four studies (Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin, Midilli, and Baysal, 2018; Ugras et al., 2018); mahur makam in one study (Inangil, Vural, Dogan and Korpe, 2020); and acemasiran makam in four studies (Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Zengin et al., 2013). The music therapy was compared with standard medical care (Aktas and Karabulut, 2019; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin, Midilli, and Baysal, 2018; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Pinar and Tel, 2019; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) or with no music (Bekiroglu et al., 2013; Ergin and Yucel, 2019; Inangil et al., 2020; Sezer, 2012; Ugur et al., 2016) (Types of control conditions varied as shown in table 3). None of the included studies investigated Sufi music therapy with concurrent therapies.

There was variation among studies in the number and duration of music therapy sessions provided. Whereas some studies used music therapy before, during and

after an operation (Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Ugras et al., 2018; Zengin et al., 2013), others used it in regular sessions. The number of sessions ranged from one to 28 over five days to eight weeks, and each session lasted 15 to 60 minutes. Although there were differences in the number and times of measurement, almost all of the studies measured outcomes before and after the intervention; one study measured outcomes only after the intervention (Parlar Kilic et al., 2015), and one did not report when outcome assessments were carried out (Ovayolu et al., 2006). (see table 3).

4.4. Quality Assessment

Eleven of the studies were of low methodological quality (Bekiroglu et al., 2013; Cantekin and Tan, 2013; Cinar et al., 2016; Cigerci and Ozbayir, 2016; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Parlar Kilic et al., 2015; Pinar and Tel, 2019; Sezer, 2012;), while eight studies had moderate methodological quality (Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Ozdemir et al., 2019; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Ugur et al., 2016; Zengin et al., 2013). Only two of the studies were of high methodological quality (Aktas and Karabulut, 2019; Diri, Cetinkaya and Gul, 2019). The most common reasons for low scores were a lack of blinding of participants or health personnel due to the nature of interventions and unclear risk of selective reporting of outcomes. Insufficient information on whether outcome assessments were conducted blind to group membership was also a reason for low scores. Long term attrition bias was not applicable to most studies because outcomes were assessed immediately following the intervention.

See Table 2 for the full assessment of the risk of bias of individual studies.

4.5. Primary Outcome: Anxiety

Anxiety is the primary outcome of this review. Anxiety was the primary outcome of 15 studies (Cigerci and Ozbayir, 2016; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) and was measured by the State-Trait Anxiety Inventory (STAI), only one study measured anxiety as a primary outcome using the Beck Anxiety Inventory (Ergin and Yucel, 2019). Three studies measured anxiety as a secondary outcome using the STAI (Aktas and Karabulut, 2019; Cantekin and Tan, 2013) or the Hamilton Anxiety Scale (HAM-A) (Bekiroglu et al., 2013).

4.6. Synthesis of Results

4.6.1. Meta-analysis of Sufi music therapy with makams' effects on anxiety in comparison to TAU/ no intervention

A total of 18 studies (Aktas and Karabulut, 2019; Bekiroglu et al., 2013; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) with1454 participants were included in a random-effects model for anxiety. The overall standardised mean difference (SMD) of those studies suggests that there is likely to be a real effect favouring Sufi music interventions with makams (SMD= -1.15, 95% CI, -1.64 to -0.65). However, the test

for statistical heterogeneity indicated, the results were significantly inconsistent across the studies (I^2= 94%). The forest plot and results of this meta-analysis are shown in Figure 2.

In figure 3, the funnel plot for Sufi makam music's effect on anxiety reveals possible publication bias, probably on the basis that positive results are more likely than negative to be published (Egger, 1997). Another source of this asymmetry could be the variation of methodological quality. Finally, there are limitations to the interpretation of this plot, and this asymmetric result may arise by chance.

According to the GRADE criteria for quality (Grade working group, 2004:1490), the evidence of Sufi music with makams' effect on anxiety is rated as very low, because of serious risk of bias and very serious inconsistency across the studies (see figure 4 and figure 8).

4.6.2. Sensitivity Analysis of primary outcome

As part of the sensitivity analysis of studies that used the STAI as well as HAM-A and BAI to measure anxiety, studies with a high risk of bias (Bekiroglu et al., 2013; Cantekin and Tan, 2011; Cigerci and Ozbayir, 2015; Cinar et al., 2016; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Parlar Kilic et al., 2015) were excluded. The combined SMD for the nine remaining studies (Aktas and Karabulut, 2019; Diri, Cetinkaya and Gul, 2019; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Ozdemir et al., 2019; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) with a total sample size of 590 participants was -0.74 (95% CI, -1.22, -0.26; I^2= 87%). The overall SMD of those studies suggests a significant effect but considerable variance across them (heterogeneity) (see figure 5).

4.6.3. Sub-group analysis of music therapy's effects on anxiety

Type of outcome

To explore where the inconsistency lies among studies, subgroup analyses were conducted. Heterogeneity was unlikely to be due to music types which did not differ across the studies; 15 studies used music with a specific makam/s intervention (Bekiroglu et al., 2013; Cantekin and Tan, 2013; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Ergin, Midilli, and Baysal, 2018; Inangil, Vural, Dogan and Korpe, 2020; Kocabas and Khorshid, 2012; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013), one study used Turkish music with unspecified makams (Cigerci and Ozbayir, 2016) and two used Sufi music with an unspecified makam (Aktas and Karabulut, 2019; Ovayolu et al., 2006).

However, grouping studies by the type of outcome (state anxiety [n=1278] and anxiety in general [n=176]) revealed the source of at least some of the inconsistency between studies (see figure 6). For state anxiety, the combined SMD for 15 studies with a total of 1278 participants (Aktas and Karabulut, 2019; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) was -0.90 (95% CI, -1. 40 to -0.41; $p< 0.00001$; $I^2= 94\%$). This result indicated a significant effect but with continued high variance across studies (heterogeneity), possibly due to the outliers whose results were disparate from the remaining studies (Surucu et al., 2018; Dogan and Senturan, 2012). The results without these two studies (Surucu et al., 2018;

Dogan and Senturan, 2012) showed a reduced effect size (SMD -0.55; 95% CI, -0.77, to -0.33; p=0.0007) but also a reduction in variance resulting in an improvement in the moderate level of heterogeneity (I^2= 65%).

Repetitions of intervention's effects on anxiety

We conducted subgroup analyses of studies with a single therapy or those with repeated applications in order to explore further where the inconsistency lay across studies. The combined SMD of five studies with a total of 354 participants (Bekiroglu et al., 2013; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Ergin and Yucel, 2019; Toker and Komurcu, 2017) with a repeated music intervention model applied for varied periods was significant with a substantial level of heterogeneity [SMD-0.44 (95% CI, -0.84 to -0.03; p = 0.006; I^2= 72%)]. However, studies that examined Sufi music with makam in a single application during operations or procedures with a total of 1100 participants (Aktas and Karabulut, 2019; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Ugras et al., 2018; Zengin et al., 2013) had a statistically significant effect on anxiety [SMD-1.44 (95% CI, -2.09 to -0.79; p< 0.00001; I^2= 95%)], albeit with significant variation across studies. The forest plot and results of subgroup analyses are illustrated in Figure 7.

4.7. Secondary Outcomes

Other mental health outcomes, including depression, stress, anger, and other psychological symptoms, are secondary outcomes of this review (Table 3).

Music therapy's effects on depression were measured as an outcome in one study. Ugur et al. (2017) measured depression as a primary outcome using the Geriatric

Depression Scale (GDS) and reported that Sufi music therapy with makams had a significant effect on depression (with Mean Difference [MD] -0.71, 95% CI -1.21, -0.20).

Cantekin and Tan (2013) measured stress in 100 patients undergoing haemodialysis by means of the Haemodialysis Stressor Scale (HSS) and found that Sufi music therapy with makams had a statistically significant effect (MD= -1.17; 95% CI, -1.59 to -0.74; *p* <0.00001). The primary outcomes of Sezer's (2012) study with a total of 14 participants were anger measured by the State-Trait Anger Scale and psychological symptoms measured by the Brief Symptom Inventory. However, neither result was statistically significant. Pinar and Tel (2019) found that Sufi music using makams had no beneficial effect on positive symptoms of schizophrenia using the Scale for Assessment of Positive Symptoms of Schizophrenia (MD= 2.86, 95% CI, -12.08 to 17.80, *p* <0.71).

5. Discussion

5.1. Summary of main findings

This systematic review identified 21 eligible randomised trials evaluating the effect of Sufi music therapy with makams on mental health outcomes, of which 18 were included in a meta-analysis totalling 1454 participants. The meta-analysis found that Sufi makam music significantly reduced anxiety. However, the evidence for all the outcomes is of limited quality. For our primary outcome anxiety, we judged the evidence using GRADE as very low quality because of publication bias, risk of bias and inconsistency. One study reported that Sufi music therapy with makams had a significant effect on depression, but this was also of lower quality.

In the 18 trials investigating Sufi makam music's effect on anxiety, those that measured outcomes after a single session appeared to have a more beneficial effect on levels of anxiety than interventions where more than one session was provided. However, the mechanism by which this music reduced anxiety was unclear. It might be related to music's distractive nature, similar to the effects of other distractive activity during surgery or an intervention such as aromatherapy (Wotman et al., 2017) or nature-based sounds (Amiri, Sadeghi, and Bonabi 2017). Nevertheless, our findings suggest that Sufi makam music might have the most beneficial effect when giving once during a medical or surgical procedure rather than given repeatedly and thereby this less intensive intervention may be more usefully tested in future trials.

It is noteworthy that Sufi makam music's effect on anxiety was limited to state anxiety, which is defined as people's anxiety about a specific situation (Spielberger, 1971). Three studies (Bekiroglu et al., 2013; Ergin and Yucel, 2019; Ovayolu et al., 2006) that presented results without distinguishing state-trait anxiety found insufficient evidence to support any beneficial effect. In the remaining 15 studies (Aktas and Karabulut, 2019; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) there was evidence of a beneficial effect of Sufi makam music therapy on state anxiety. This suggests that Sufi music therapy with makams might be most useful in reducing anxiety in specific situations like a surgical or medical procedure. However, in recent decades, several studies have illustrated the beneficial effect of music listening on preoperative and postoperative anxiety, irrespective of the type of music (Bradt, Dileo and Shim, 2013; Hole et al., 2015; Graff et al., 2019). This indicates that

the beneficial effect of listening to music during the perioperative period, may not be specific to Sufi music but rather to music in general. Therefore, there is a need for comparative trials to evaluate the specific effects of Sufi makam music compared with other types of music on state anxiety, alongside a need for further evaluation of the effects of Sufi makam music in other situations.

Our results suggest that while Sufi makam music may reduce depression, anxiety and the stress of haemodialysis, it has no benefit in reducing anger and positive symptoms of schizophrenia. However, the overall quality of the studies, their small sample sizes that were likely to be under-powered and the high levels of heterogeneity between study results mean that their findings should be interpreted with considerable caution and further evaluation is needed.

5.2. Delivery of the music, outcomes and generalisability

All the participants passively listened to recorded music preselected by the researcher, except in one study (Cigerci and Ozbayir, 2016), where participants indicated their preference for music. Because of this lack of focus on participants' preferences or their musical backgrounds, the effects of individualised interventions were not examined. Music was delivered either by headphones or stereo music players (Aktas and Karabulut, 2019; Cantekin and Tan, 2013; Cigerci and Ozbayir, 2016; Cinar et al., 2016; Diri, Cetinkaya and Gul, 2019; Dogan and Senturan, 2012; Ergin and Yucel, 2019; Ergin, Midilli, and Baysal, 2018; Inangil et al., 2020; Kocabas and Khorshid, 2012; Ovayolu et al., 2006; Ozdemir et al., 2019; Parlar Kilic et al., 2015; Pinar and Tel, 2019; Surucu et al., 2018; Toker and Komurcu, 2017; Ugras et al., 2018; Zengin et al., 2013) or collectively in a group (Bekiroglu et al., 2013; Sezer, 2012, Ugur et al., 2016).

The most common outcome measure in the studies included in this review was anxiety measured using the STAI, which is a valid and reliable scale. One study (Bekiroglu et al., 2013) used the HAM-A scale, which also has good psychometric properties (Thompson, 2015), and one study (Ergin and Yucel, 2019) used the BAI scale, which is a reliable and valid measure (Julian, 2011). Therefore, general reliability and validity of the studies' measurements give credence to the evidence evaluated.

The results of our review have limited generalisability as all the studies took place in Turkey, and most of the studies included speaking and understanding the Turkish language as an inclusion criterion. Thus, our results cannot be generalised to other cultures, populations or age groups due to insufficient evidence.

5.3. Quality of the studies and evidence derived

Only two of the studies (Aktas and Karabulut, 2019; Diri, Cetinkaya and Gul, 2019) were rated as high quality. For this reason, extracting data from the papers was at times problematic, for example, some papers' results contained unusually narrow confidence intervals (Bekiroglu et al., 2013; Dogan and Senturan, 2012; Ovayolu et al., 2006) or unclear study methods and designs. To clarify missing or unusual data, and to check unclear information about studies, authors (Bekiroglu, T.; Ergun, G.; Gulsen, M.; Ovayolu, N.; Senturan, L.) were contacted via email. All responded, confirming that the published data were correct.

Although our results indicated there was considerable heterogeneity in the results, subgroup analyses did not explain clearly where this lay. Possible explanations were small sample sizes, low-quality, varied makam types used in the interventions and the varied designs of the studies.

5.4. Strengths and Limitations of the review

To our knowledge, this is the first systematic review and meta-analysis of the impact of Sufi music therapy with makams on mental health outcomes. A rigorous method and comprehensive search strategy were implemented, which included both Turkish and English language publications. Studies mainly centred on anxiety; thus, meta-analyses of the studies were performed for these common outcomes.

A possible limitation of this review might be that studies published in other languages could not be included. In the funnel plot, asymmetry revealed possible publication bias, as probably because positive results were more likely than negative to be published, which might be another limitation of this review. Further research might focus on the adaptation of Sufi makam music to other cultures. Another potential limitation was the inclusion of studies of low methodological quality, which may have had an impact on the overall effect found in the meta-analyses and our conclusions.

6. Conclusion

Sufi Makam music may be a vehicle to reduce state anxiety of patients undergoing an operation or treatments like chemotherapy or haemodialysis. However, due to methodological limitations in the studies, such as variation in mental health problems, outcome measures, the timing of the interventions, and makams used in the interventions across the studies, we advise caution in concluding that Sufi makam music is effective in reducing anxiety or other forms of mental distress. Further, well designed, fully powered studies are needed comparing Sufi makam music with other types of music therapies, as well as research investigating its effects when adapted to other cultures. More research is also required to identify which specific makams are more effective than other forms of music in reducing anxiety and whether participants

need to have a connection or belief in Sufism in order to benefit from this type of therapy.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Data and materials are available on request from the first author.

Competing interests

The authors declare that they have no competing interests.

Funding

The authors received no specific funding for this work. RNGD is funded by the Ministry of Education for her doctoral studies. BC contribution to this work is supported by the Marie Curie Core grant (MCCC-FCO-16-U).

Author's contributions

RNGD was responsible for conducting the searches in 2017 and in 2020, data extraction, analysis, interpretation, and writing. She also performed the systematic review and run meta-analysis. AA and MK provided the initial motivation for the systematic review, and they reviewed, revised and commented on the manuscript. AA contributed to the search. BC contributed to methodological issues of the paper,

statistical analysis and meta-analysis of the results. All authors contributed to the development of the final version of the manuscript and gave approval to the final version to be published.

Acknowledgements

We are grateful to Merve Cetinkaya (MC), PhD, for her contribution to conduct the search.

References

[1] Biley, FC. (1999). Music as therapy: A brief history. *Complementary therapies in nursing and midwifery*, 5.5: 140-143.

[2] Aldridge, D. (1993). Music therapy research II: Research methods suitable for music therapy. *The Arts in Psychotherapy*, 20.2: 117-131.

[3] Ovayolu N, Ucan O, Pehlivan S, Pehlivan Y, Buyukhatipoglu H, Savas MC, & Gulsen MT. (2006). Listening to Turkish classical music decreases patients' anxiety, pain, dissatisfaction and the dose of sedative and analgesic drugs during colonoscopy: a prospective randomised controlled trial. *World journal of gastroenterology*: *WJG*, 12.46: 7532.

[4] Bradt J, Dileo C, Potvin N. (2013). Music for stress and anxiety reduction in coronary heart disease patients. *The Cochrane Library*.

[5] Hole, J., Hirsch, M., Ball, E., & Meads, C. (2015). Music as an aid for postoperative recovery in adults: a systematic review and meta-analysis. *The Lancet*, *386*(10004), 1659-1671.

[6] Graff, V., Cai, L., Badiola, I., & Elkassabany, N. M. (2019). Music versus midazolam during preoperative nerve block placements: a prospective randomised controlled study. *Regional Anesthesia & Pain Medicine*, *44*(8), 796-799.

[7] Maratos A, Gold C, Wang X, & Crawford M. (2008). Music therapy for depression. *The Cochrane Library*.

[8] Ueda T, Suzukamo Y, Sato M, & Izumi SI. (2013). Effects of music therapy on behavioral and psychological symptoms of dementia: a systematic review and meta-analysis. *Ageing research reviews*, 12.2: 628-641.

[9] Geretsegger M, Mössler KA, Bieleninik Ł, Chen XJ, Heldal TO, & Gold C. (2017). Music therapy for people with schizophrenia and schizophrenia-like disorders. *The Cochrane Library*.

[10] Trimingham, JS. (1971). The Sufi Orders in Islam. *New York: Oxford University*.

[11] Benek BS, Sakar H, Gumustekin K, & Bayram R. (2015). An example for the application of music therapy in the medical history: Divrigi Darüssifa. *Acta Medica* Anatolia, 3.2.

[12] Giray, HS. (2008). Çağlar Boyu Müzikle Tedavi ve Uygulandığı Hastalıklar. Master dissertation. *Kocaeli University SBE*.

[13] Ederer, EB. (2011). *The theory and praxis of makam in classical Turkish music 1910–2010*. University of California, Santa Barbara.

[14] Sağun MAK and Bolat B. (2016). Classification of classic Turkish music makams by using deep belief networks. In: *INnovations in Intelligent SysTems and Applications (INISTA), 2016 International Symposium on*. IEEE. p. 1-6.

[15] Erdal G and Erbaş İ. (2013). Darüşşifas Where Music Threapy was Practiced During Anatolian Seljuks and Ottomans/Selçuklu ve Osmanlı Darüşşifalarında Müzikle Tedavi. *Journal of History Culture and Art Research*, 2.1: 1-19.

[16] Tanriover, G. (2010). The Methods of Therapy with Music. *Fine Arts*, 5.3: 150-157.

[17] Higgins JPT and Green S. (2011). Assessing risk of bias in included studies. *Cochrane handbook for systematic reviews of interventions 5.1.0* (updated March 2011), 187-241.

[18] Cohen, J. (1988). Statistical power analysis for the behavioural sciences. Hilsdale. *NJ: Lawrence Earlbaum Associates*, 2.

[19] Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses*. BMJ,* 327(7414), 557-560.

[20] Schünemann HJ, Oxman AD, Higgins JPT, Vist GE, Glasziou P, Akl E, Guyatt GH on behalf of the Cochrane GRADEing Methods Group and the Cochrane Statistical Methods Group. (2017). "Chapter 11: Completing' Summary of findings' tables and grading the confidence in or quality of the evidence", In: Higgins JPT, Churchill R, Chandler J, Cumpston MS (editors), *Cochrane Handbook for Systematic Reviews of Interventions* version 5.2.0 (updated June 2017). Cochrane. Available from www.training.cochrane.org/handbook.

[21] Atkins, D., Best, D., Briss, P. A., Eccles, M., Falck-Ytter, Y., Flottorp, S., Guyatt, G.H., Harbour, R.T., Haugh, M.C., Henry, D.& Hill, S. (2004). Grading quality of evidence and strength of recommendations. *BMJ (Clinical research ed.)*, 328(7454), 1490-1490.

[22] Aktaş, Y. Y., & Karabulut, N. (2019). The use of cold therapy, music therapy and lidocaine spray for reducing pain and anxiety following chest tube removal. *Complementary therapies in clinical practice*, *34*, 179-184.

[23] Bekiroglu T, Ovayolu N, Ergun Y, & Ekerbicer HC. (2013). Effect of Turkish classical music on blood pressure: a randomised controlled trial in hypertensive elderly patients. *Complementary therapies in medicine*, 21.3: 147-154.

[24] Cantekin I and Tan M. (2013). The influence of music therapy on perceived stressors and anxiety levels of hemodialysis patients. *Renal failure*, 35.1: 105-109.

[25] Cigerci Y and Ozbayir T. (2016). The effects of music therapy on anxiety, pain and the amount of analgesics following coronary artery surgery. *Turkish Journal of Thoracic and Cardiovascular Surgery*, 24.1: 044-050.

[26] Cinar D, Olgun N, Duran S, & Arat S. (2016). Klasik Türk Müziğinin Ağrı ve Kaygı Düzeyine Etkisi: Girişimsel Kardiyolojide Randomize Kontrollü Bir Çalışma. *Turkiye Klinikleri Journal of Nursing Sciences*, 8.2: 140-145.

[27] Diri, M. A., Çetinkaya, F., & Gül, M. (2019). The Effects of Listening to Music on Anxiety, Pain, and Satisfaction during Urodynamic Study: A Randomized Controlled Trial. *Urologia internationalis*, *103*(4), 444-449.

[28] Dogan M and Senturan L. (2012). The effect of music therapy on the level of anxiety in the patients undergoing coronary angiography. *Open Journal of Nursing*, 2.03: 165.

[29] Ergin, E., & Yücel, Ş. Ç. (2019). The Effect of Music on the Comfort and Anxiety of Older Adults Living in a Nursing Home in Turkey. *Journal of religion and health*, *58*(4), 1401-1414.

[30] Ergin, E., Midilli, T. S., & Baysal, E. (2018). The effect of music on dyspnea severity, anxiety, and hemodynamic parameters in patients with dyspnea. *Journal of Hospice & Palliative Nursing*, *20*(1), 81-87.

[31] Inangil, D., Vural, P. I., Doğan, S., & Körpe, G. (2020). Effectiveness of Music Therapy and Emotional Freedom Technique on Test Anxiety in Turkish Nursing Students: A Randomised Controlled Trial. *European Journal of Integrative Medicine*, *33*, 101041.

[32] Kocabas P and Khorshid L. (2012). A comparison of the effects of a special gynaecological garment and music in reducing the anxiety related to gynaecological examination. *Journal of clinical nursing*, 21.5-6: 791-799.

[33] Ozdemir, U., Taşcı, S., Yıldızhan, E., Aslan, S., & Eser, B. (2019). The effect of classical Turkish music on pain severity and anxiety levels in patients undergoing bone marrow aspiration and biopsy. *Pain Management Nursing*, *20*(1), 82-87.

[34] Parlar Kilic S, Karadag G, Oyucu S, Kale O, Zengin S, Ozdemir E, & Korhan EA. (2015). Effect of music on pain, anxiety, and patient satisfaction in patients who present to the emergency department in Turkey. *Japan Journal of Nursing Science*, 12.1: 44-53.

[35] Pinar, S. E., & Tel, H. (2019). The Effect of Music on Auditory Hallucination and Quality of Life in Schizophrenic Patients: A Randomised Controlled Trial. *Issues in mental health nursing*, *40*(1), 50-57.

[36] Sezer, F. (2012). The psychological impact of Ney music. *The Arts in Psychotherapy*, 39.5: 423-427.

[37] Surucu, S. G., Ozturk, M., Vurgec, B. A., Alan, S., & Akbas, M. (2018). The effect of music on pain and anxiety of women during labour on first time pregnancy: A study from Turkey. *Complementary therapies in clinical practice*, *30*, 96-102.

[38] Toker E and Komurcu N. (2017). Effect of Turkish classical music on prenatal anxiety and satisfaction: A randomised controlled trial in pregnant women with pre-eclampsia. *Complementary therapies in medicine*, 30: 1-9.

[39] Ugras, G. A., Yıldırım, G., Yüksel, S., Öztürkçü, Y., Kuzdere, M., & Öztekin, S. D. (2018). The effect of different types of music on patients' preoperative anxiety: A randomised controlled trial. *Complementary therapies in clinical practice*, *31*, 158-163.

[40] Ugur HG, Yaman Aktaş Y, Orak OS, Saglambilen O, & Aydin Avci İ. (2016). The effect of music therapy on depression and physiological parameters in elderly people living in a Turkish nursing home: a randomised-controlled trial. *Aging & mental health*, 21.12: 1280-1286.

[41] Zengin S, Kabul S, Al B, Sarcan E, Doğan M, & Yildirim C. (2013). Effects of music therapy on pain and anxiety in patients undergoing port catheter placement procedure. *Complementary therapies in medicine*, 21.6: 689-696.

[42] Guyatt, G. H., Oxman, A. D., Vist, G. E., Kunz, R., Falck-Ytter, Y., Alonso-Coello, P., & Schünemann, H. J. (2008). GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ (Clinical research ed.)*, 336(7650), 924-926.

[43] Deeks JJ, Higgins JPT, Altman DG (editors) on behalf of the Cochrane Statistical Methods Group. (2017). Chapter 9: Analysing data and undertaking meta-analyses. In: Higgins JPT, Churchill R, Chandler J, Cumpston MS (editors*), Cochrane Handbook*

for Systematic Reviews of Interventions version 5.2.0 (updated June 2017), Cochrane. Available from www.training.cochrane.org/handbook.

[44] Wotman M, Levinger J, Leung L, Kallush A, Mauer E, & Kacker A. (2017) The Efficacy of Lavender Aromatherapy in Reducing Preoperative Anxiety in Ambulatory Surgery Patients Undergoing Procedures in General Otolaryngology. *Laryngoscope investigative otolaryngology*, 2.6: 437-441.

[45] Amiri Mj, Sadeghi T, and Bonabi Tn. (2017). The effect of natural sounds on the anxiety of patients undergoing coronary artery bypass graft surgery. *Perioperative Medicine*, 6.1: 17.

[46] Spielberger, CD. (1971). Notes and comments trait-state anxiety and motor behavior. *Journal of motor behavior*, 3.3: 265-279.

[47] Thompson, E. (2015). Hamilton rating scale for anxiety (HAM-A). *Occupational Medicine (London)*, 65.7: 601.

[48] Julian L. J. (2011). Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). Arthritis care & research, 63 Suppl 11(0 11), S467–S472. https://doi.org/10.1002/acr.20561.

Table 1; Study Characteristics

Study				*Subjects*				*Intervention*			*Outcome*	
Author	**Year**	**Country**	**Design**	**Sample Size *n***	**Age**	**Gender**	**Diagnosis**	**Music type**	**Sessions**	**Instrument**	**Rater**	**Results**
Aktas and Karabulut, 2019	2019	Turkey	Randomised controlled trial	120	18+	Mixed F=29 M=91	Anxiety and pain of the patients undergoing the chest tube removal (CTR) procedure	Turkish Sufi music with ney-unspecified makam	30 min. during CTR	The visual analogue scale (VAS) - pain, and the State-Trait Anxiety Inventory (STAI-S and STAI-T)	Self-report independent; single-blind	No differen between groups in pa scores a anxiety
Bekiroglu et al., 2013	2013	Turkey	Randomised controlled trial	60	60-89 yrs	Mixed F= 26 M= 34	Hyper-tension and anxiety	Turkish classical music (Nihavend and Buselik makam)	25 min everyday (28 days)	A sphygmomanometer for blood pressure, and Hamilton anxiety scale (HAM-A) for anxiety	Independent; unblinded	Reduced Blood pressure a anxiety
Cantekin and Tan, 2011	2011	Turkey	Randomised controlled trial	100	18+	Mixed F= 47 M= 53	Haemodialysis Stress, and anxiety	Turkish music therapy (Rast and Usak makam)	3 times a week during haemodialysis sessions (4 week)	Haemodialysis Stressor Scale (HSS), and State-Trait Anxiety Inventory (STAI Form TX)	Self-report independent; single-blind	Decreased haemodialy stress a anxiety
Cigerci and Ozbayır, 2011	2011	Turkey	Randomised controlled trial	68	28-75 yrs	Mixed F= 16 M= 52	Anxiety of the patients undergoing coronary artery surgery	Turkish classical and folk music (makam is unknown)	One hour 30 minutes before operation, once for 30 min in the Intensive Care Unit, 30 min every day in the ward	The visual analogue scale (VAS) - pain, and the State-Trait Anxiety Inventory (STAI-S and STAI-T)	Independent Self report; unblinded	No differen in anxie level, reduced pa perception and t amount analgesics

Cinar et al., 2016	2013	Turkey	Randomised controlled trial	60	30-75+ yrs	Mixed F=20 M=40	Anxiety of the patients undergoing intracoronary stenting	Turkish classical music (Usak makam)	During the coronary angiography	State-Trait Anxiety Inventory, Visual Analogue Scale	Self-report Independent unblinded	Reduced anxiety lev and perception pain
Diri, Cetinkaya and Gul, 2019	2019	Turkey	Randomised controlled trial	70	18+	Mixed F=40 M=30	Anxiety of Patients undergoing urodynamic tests	Sufi music (instrumental ney music)-Huseyni makam	Started 10 min before the procedure and continue during the procedure.	Anxiety -STAI Pain -VAS Satisfaction - VAS Willingness to repeat the test - VAS	Self-report independent unblinded	No effect pain a anxiety lev of patie during UDS
Dogan and Şenturan, 2012	2012	Turkey	Randomised controlled trial	200	18+	Mixed F=60 M=140	intraoperative anxiety of the patients undergoing coronary angiograph	Turkish music therapy (Huseyni makam)	During the coronary angiography	State-Trait Anxiety Inventory	Self-report unblinded	Significantly decreased the avera scores of t state anxiet
Ergin and Yucel, 2019	2019	Turkey	Randomised controlled trial	56	60+	Mixed	Anxiety of older people living in a nursing home	Classical Turkish music-Nihavend makam	30 min a day for 21 Days	48 Item General Comfort Questionnaire Beck Anxiety Inventory (BAI) Mini-Mental State Examination (MMSE)	Self-report Unblinded	Improved comfort, Reduced anxiety

Ergin, Midilli, and Baysal, 2018	2018	Turkey	Randomised controlled trial	60	18+	Mixed F=36 M=24	Pain, anxiety, and patient satisfaction of patients with dyspnoea in Chest Diseases Service of a public hospital	Music therapy-huseyni makam	One session of 30 min	Anxiety -STAI Dyspnea severity - VAS	Self-report Independent Unblinded	Decreased anxiety a severity dyspnea
Inangil, Vural, Dogan and Korpe	2020	Turkey	Randomised controlled trial	90	18-22 yrs	Mixed F= 74 M= 16	nursing student's test anxiety	Turkish classical music-in Mahur makam	15 min. before an OSCE exam	20 item Situational Anxiety Scale - nursing student's test anxiety	Self-report Unblinded	Reduced t pre-test anxiety
Kocabas and Khorshid, 2011	2009	Turkey	Randomised controlled trial	90	15-49 yrs	Female	anxiety related to gynaecological examination	Turkish music (Nihavend makam) and a special gynaecological garment's effect	During gynaecological examination	State-Trait Anxiety Inventory Form (STAI)	Self- report Not blind	examinatio garment reduces o source distress w pelvic examinatio but mu does r produce a positive effect
Ovayolu et al., 2006	2005-2006	Turkey	Randomised controlled trial	60	18-75 yrs	Mixed F= 32 M= 28	anxiety, pain, dissatisfaction during the colonoscopy	Turkish Music (ney- reed flute) makam unknown	Before and during the procedure (apx. 30 min)	The State Trait Anxiety Inventory (STAI), and Visual Analog Scale (VAS)	Self- report, blinding unknown	decreased t dose sedative a analgesic medication required patients, decreased anxiety lev and pa scores significantly

											increased satisfaction scores a patients' comfort a tolerance
Ozdemir, Tasci, Yildizhan, Aslan and Eser, 2019	2019	Turkey	Randomised controlled trial	30	18+	Mixed F=9 M=21	Pain and anxiety in patients who undergoing bone marrow aspiration and biopsy in an oncology hospital	Turkish classical music-Acemasiran Makam	During procedure	The State Anxiety Inventory (STAI-State part), and Visual Analog Scale (VAS)	Self-report independent Unblinded	increased anxiety lev of patie undergoing bone marr aspiration and biop but decreas pain and systolic a diastolic blood pressure, therefore increasing tolerance to t procedure
Parlar Kilic et al., 2012	2012	Turkey	Randomised controlled trial	200	18+	Mixed F= 94 M=106	Pain, anxiety, and patient satisfaction in patients who present to the emergency	Turkish classical music (Acemasiran makam)	During the appearance at emergency services	The State–Trait Anxiety Inventory-State Anxiety Scale (STAI-S) and Visual Analog Scale- level of pain (VASP)	Independent single-blind	decreased pain and anxiety sc and increas satisfaction score
Pinar and Tel, 2019	2019	Turkey	Randomised controlled trial	28	20-58 yrs	Mixed gender	Schizophrenic patients who hospitalised in the psychiatry department of hospitals	Music – Rast makam	15 min whenever auditory hallucinations appeared during their	Assessment of positive symptoms of schizophrenia-SAPS 7 items scale for the assessment of	Self-report Unblinded	Positive effects on t positive symptoms and quality life of t patients having

									stay in hospital	auditory hallucinations 26 item Quality of life- WHOQAL-BREF		auditory hallucinatio
Sezer, 2012	2012	Turkey	Randomised controlled trial	14	18-23 yrs	Mixed F=8 M=6	Anger and psychological symptoms	Turkish Sufi Music (ney-reed flute)	40-45 min twice a week (7 weeks)	Brief Symptom Inventory, and State Trait Anger Scale	Self- report single- blind	Reduced anger and psychologic symptoms
Surucu, et al., 2018	2018	Turkey	Randomised controlled trial	50	16-28 yrs	Female	Anxiety and pain of pregnant women when in active phase of labour	Turkish Classical music- Acemasiran makam	3 hours (20 min listening- 10 min resting) during the active phase of labour	Pain –VAS Anxiety -STAI	Independent Self-report Unblinded	Significantly reduced anxiety le and reduc the pain lev
Toker and Komurcu, 2017	2012-2014	Turkey	Randomised controlled trial	70	18+	Female	anxiety and satisfaction in pregnant women with preeclampsia	Turkish classical music therapy (Nihavend and Buselik makams)	30 min a day for seven days	State trait anxiety inventory (STAI TX-I), The Newcastle satisfaction with nursing scale (NNCS), and Non-stress test (NST)	Independent blinding unknown	Increased satisfaction decreased blood pressure, t positive effe on fa movement counts, a minimalisin effect on fa heart ra but no effe on anxie level
Ugras et al., 2018	2018	Turkey	Randomised controlled trial	180	18-65 yrs	Mixed F=53	Preoperative anxiety	Turkish instrumental music with	For at least 30 min *before* the	State- Trait Anxiety Inventory (STAI-State anxiety part) Systolic blood pressure (SBP),	Independent Self-report	Reduced preoperativ anxiety

						M= 127		ney- Huseyni makam Natural sounds Classical western music- Four seasons from Vivaldi	procedure in waiting room	diastolic blood pressure (DBP), heart rate (HR) and cortisol levels	blinding unknown	
Ugur et al., 2015	2015	Turkey	Randomised controlled trial	64	76+-	Mixed F= 22 M= 42	Depression in elderly people and systolic blood pressure (SBP)	Turkish Traditional Music and Turkish Sufi Music	20 min 3 times a week (8 weeks)	Geriatric Depression Scale (GDS) and Elderly Information Form	Self-report single-blind	Decreased depression level and SE
Zengin et al., 2013	2012	Turkey	Randomised controlled trial	100	18-75 yrs	Mixed F= 48 M= 52	pain and anxiety in patients undergoing port catheter placement procedure	Turkish classical music (Acemasiran makam)	Before, during and after the procedure	The state-trait anxiety inventory (STAI), and Visual Analogue Scale (VAS)	independent Not blind	Reduced anxiety, pa Blood Pressure, Heart Ra and Respiratory Rate befo during, a after invasi procedures

Table 2; Assessment of risk of bias

Author	Random Sequence Generation	Allocation Concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data (short term 1 day -6 weeks)	Incomplete outcome data (long term >6 weeks)	Selective reporting
Aktas and Karabulut, 2019	+	+	-	+	+	N/A	+
Bekiroglu et al., 2013	?	?	-	-	+	N/A	+
Cantekin and Tan, 2011	+	-	-	?	+	+	-
Cigerci and Ozbayir, 2015	+	-	-	?	+	N/A	-
Cinar et al., 2016	?	?	-	?	+	N/A	+
Diri, Cetinkaya and Gul, 2019	+	+	-	+	+	N/A	+
Dogan and Şenturan, 2012	+	-	-	?	+	N/A	-
Ergin and Yucel, 2019	-	-	-	?	+	N/A	+
Ergin, Midilli, and Baysal, 2018	+	+	-	?	+	N/A	+
Inangil et al., 2020	+	+	-	?	+	N/A	+
Kocabas and Khorshid, 2011	-	-	-	-	+	N/A	-
Ovayolu et al., 2006	+	?	-	?	?	N/A	?
Ozdemir et al., 2019	+	+	-	?	+	N/A	+
Parlar Kilic et al., 2015	+	-	-	?	+	N/A	?
Pinar and Tel, 2019	?	?	-	?	+	+	-

Sezer, 2012	?	?	-	?	+	+	?
Surucu et al., 2018	+	+	-	?	+	N/A	+
Toker and Komurcu, 2017	+	+	-	?	+	N/A	+
Ugras et al., 2018	+	+	-	?	+	N/A	+
Ugur et al., 2016	+	+	-	-	+	+	+
Zengin et al., 2013	+	+	-	?	+	N/A	-

Table 3; Interventions

Authors	Number included, gender and mean age of participants	Intervention	Control	Intervention type	Music selection	Social context	Primary aim of study	Primary outcome (p) and secondary outcome (s)	Time-period	Time-point
Aktas and Karabulut, 2019	120 Mixed gender 91 males, 29 females Mean ages; Cold therapy: 62.60±12.11 Music therapy: 64.13±9.59 Lidocaine spray: 64.80±7.07 Control group: 65.80±7.23	-Turkish Sufi music with ney-unspecified makam -Cold therapy -Lidocaine spray	Treatment as usual (TAU)	Passive listening	Preselected music	Individual	Pain and anxiety following CTR among patients with cardiac surgery	Pain- Visual Analog Scale (VAS) (p) Anxiety- State Trait Anxiety Inventory (STAI) (s)	30 min. during CTR	Before and immediately after CTR and 20 minute after CTR

Bekiroglu et al., 2013	60 Mixed gender; 34 male, 26 female Mean age; between 60-89 yrs	Turkish music therapy (Nihavend and Buselik makams)	Bed rest + no music intervention	Passive listening	Preselected music by the researcher	group	Blood pressure of hypertension patients	Blood pressure (p) Hamilton anxiety scale scores (s)	25 min every day for 28 days	Before and after intervention (exact time not specified)
Cantekin and Tan, 2011	100 Mixed gender; 53 male, 47 female Mean age; between 19- 40+	Turkish music therapy (Rast and Usak makam)	TAU	Passive listening	Preselected music by the researcher	individual	Treatment-related stress and anxiety of haemodialysis patients	Haemodialysis Stressor Scale (HSS) (p) State–Trait Anxiety Inventory (STAI Form TX) (s)	3 times a week during haemodialysis sessions for 4 weeks	Before and after intervention (exact time not specified)
Cigerci and Özbayır, 2011	68 mixed gender; 52 males, 16 females mean age; 61.6±10.7 years;	Turkish classical and folk music (makam unknown)	TAU + No music Intervention	Passive listening	patient's preference	individual	Anxiety in the patients undergoing coronary artery surgery	State-Trait Anxiety Inventory (p) Visual Analogue Scale (s)	One hour 30 minutes before operation, once for 30 min in the Intensive Care Unit, 30 min every day in the ward	The day before intervention and within 24 hours after intervention
Cinar et al., 2016	60 Mixed gender; 40 males, 20 females Mean age; between 30 - 75+	Turkish classical music (Usak makam)	TAU + No music Intervention	Passive listening	Preselected music by the researcher	individual	Anxiety of the patients undergoing intracoronary stenting	State-Trait Anxiety Inventory (p) Visual Analogue Scale (s)	During the coronary angiography	Before and after intervention (exact time not specified)
Diri, Cetinkaya and Gul, 2019	70 Mixed gender; 30 males, 40 females	Sufi music (instrumental ney music)- Huseyni makam	TAU	Passive listening	Preselected music by the researcher	Individual	Anxiety, pain, and stress level during UDS	Anxiety -STAI (p) Pain, Satisfaction, Willingness to	Started 10 min before the procedure and continue	15 min before the procedure and 10 min *after* UDS

	Mean age; Music therapy group: 58±10.9 Control group: 59±12.4							repeat the test – VAS (p) Mean arterial pressure and heart rates (s)	during the procedure.	
Dogan and Şenturan, 2012	200 Mixed gender; 140 male, 60 female Mean age; between 18- 60+	Turkish music therapy (Huseyni makam)	TAU + no music intervention	Passive listening	Preselected music by the researcher	Individual	Intraoperative anxiety in coronary angiography patients	State-Trait Anxiety Inventory (p)	During the coronary angiography	10 minutes before the procedure and after intervention (exact time not specified)
Ergin and Yucel, 2019	56 Mixed gender Mean age: 60+	Classical Turkish music-Nihavend makam	No music intervention	Passive listening	Preselected music by the researcher	Individual	Comfort and anxiety in older adults living in nursing homes	48 Item General Comfort Questionnaire (p) 21 item Beck Anxiety Inventory (BAI) (p) Mini-Mental State Examination (MMSE) (s)	30 min in a day for 21 Days	Before and the following day of intervention ended
Ergin, Midilli, and Baysal, 2018	60 Mixed gender; 36 males, 24 females	Music therapy-huseyni makam	TAU+ Bed rest + no music intervention	Passive listening	Preselected music by the researcher	Individual	The severity of dyspnea, anxiety, blood pressure, breathing rate,	gDyspnea severity – VAS (p) Anxiety- STAI (p)	One session of 30 min	Before and after intervention (exact time not specified)

	Mean age; 61.21±1.13						pulse rate, and blood oxygen levels in patients with dyspnea	respiratory rate (RR), heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and O2 saturation (SO2) (s) Patient satisfaction (s)		
Inangil, Vural, Dogan and Korpe, 2020	90 Mixed gender; 16 males, 74 females Mean age; 19.27	-Turkish classical music- in Mahur makam - Emotional Freedom Techniques-EFT	no music intervention	Passive listening	Preselected music by the researcher	Individual listening in a group setting	Nursing student's test anxiety	20 item Situational Anxiety Scale - nursing student's test anxiety (p) Blood pressure, pulse, O2 saturation (s)	15 min. before an OSCE exam	Before and after intervention

Kocabas and Khorshid, 2011	90 Female Mean age; for control group 31.8 ± 8.7 For garment group 34.7 ± 8.9 For garment and intervention group 34.8 ± 9.8	Turkish music therapy (Nihavend makam) + special gynaecological garment	Group one; TAU with a traditional one-piece drape Group two; TAU+ special gynaecological garment	Passive listening	Preselected music by the researcher	individual	anxiety related to gynaecological examination	State-Trait Anxiety Inventory (p)	During gynaecological examination	Before and after intervention (exact time not specified)
Ovayolu et al., 2006	60 Mixed gender; 28 male, 32 female Mean age; between 18-75 yrs	Turkish Music (ney- reed flute) makam unknown	TAU + No music intervention	Passive listening	Preselected music by the researcher	Individual	Patient's anxiety, pain and dissatisfaction feelings during colonoscopy	State-Trait Anxiety Inventory (p) Visual Analogue Scale (s)	Before and during the procedure (apx. 30 min)	not specified
Ozdemir et al., 2019	30 Mixed gender; 21 males, 9 females Mean ages; 18+	Instrumental Turkish classical music-Acemasiran Makam	TAU + No music intervention	Passive listening	Preselected music by the researcher	Individual	Patient's pain and anxiety levels during bone marrow aspiration and biopsy procedures	Pain-VAS (p) 20 Item State Anxiety Inventory (State part of STAI) (p) blood pressure, pulse rates, and respiration rates; serum cortisol, ACTH (s)	During the procedure (aprox. 30 min)	VAS- only after the intervention Rest of the outcomes measured before and after intervention (exact time not specified)

Parlar Kilic et al., 2012	200 Mixed gender; 106 male, 94 female Mean age; for music therapy group 30.15 ± 13 For control group 34.71 ± 14.14	Turkish classical Music (Acemasiran makam)	TAU + No music intervention	Passive listening	Preselected music by the researcher	Individual	pain, anxiety, and satisfaction in patients who present to the emergency department	State-Trait Anxiety Inventory (p) Visual Analogue Scale (s)	During the appearance at emergency services	After intervention
Pinar and Tel, 2019	28 Mixed gender Mean ages; for music therapy group 37.0 ± 10.65 For control group 32.78 ± 7.90	Turkish Music – Rast makam	TAU + No music intervention	Passive listening	Preselected music by the researcher	Individual	auditory hallucination and quality of life in schizophrenic patients	Scale for assessment of positive symptoms of schizophrenia SAPS (p) 7 items scale for the assessment of auditory hallucinations (p) 26 item Quality of life-WHOQAL-BREF (p)	15 min whenever auditory hallucinations appeared during their stay in hospital	The first day of hospitalisation and after discharge
Sezer, 2012	14 Mixed gender; 6 Male, 8 Female Mean age; 20.7 ± 1.48	Turkish Sufi Music (ney- reed flute)	No music intervention	Passive listening	Preselected music by the researcher	group	Undergraduate students' anger and psychological symptoms	Brief Symptom Inventory (p) State Trait Anger Scale (p)	Twice a week for 7 weeks (40-45 min)	Before and after intervention (exact time not specified)

Surucu et al., 2018	50 Female Mean age; for the experimental Group: 22.08 ± 2.32 for the control group: 21.04 ± 3.06	Turkish Classical music- Acemasiran makam	TAU + No music intervention	Passive listening	Preselected music by the researcher	Individual	Pain and anxiety of women during labour on their first pregnancy.	Pain- VAS (p) State-Trait Anxiety Inventory- STAI (p)	3 hours (20 min listening- 10 min resting) during the active phase of labour	VAS- every hour STAI- 30 min after music listening
Toker and Komurcu, 2017	70 female Mean age; 30.64 ± 5.81,	Turkish classical music therapy (Nihavend and Buselik makams)	TAU+ Bed rest + no music intervention	Passive listening	Preselected music by the researcher	Individual	Anxiety in pregnant women with preeclampsia	State-Trait Anxiety Inventory (STAI TX-I) (p) Newcastle satisfaction with nursing scale (NNCS) (s)	30 min a day for seven days	Before and after intervention (exact time not specified)
Ugras et al., 2018	180 Mixed gender; 127 males, 53 females Mean age; 35.7 ± 11.2	-Turkish instrumental music with ney- Huseyni makam -Natural sounds -Classical western music- Four seasons from Vivaldi	TAU + No music intervention	Passive listening	Preselected music by the researcher	Individual	Preoperative anxiety	State- Trait Anxiety Inventory (STAI-State anxiety part) (p) systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) and cortisol levels (s)	For at least 30 min *before* the procedure in waiting room	Before and after the music intervention
Ugur et al., 2015	64 Mixed gender; 42 males, 22 females	Turkish Traditional Music and Turkish Sufi Music	No music intervention	Passive listening	Preselected music by the researcher	group	Depression in elderly people	Geriatric Depression Scale scores (GDS) (p)	3 times a week for 8 weeks (20 min)	Before and after intervention (exact time not specified)

	Mean age; 75.00 ± 8.19							Physiological parameters via recorded in Elderly Information Form (s)		
Zengin et al., 2013	100 Mixed gender; 52 male, 48 females Mean age; for intervention group 49 ± 15.58 For control group 50.74 ± 14.01	Turkish classical music (Acemasiran makam)	TAU + surgery Intervention + No music Intervention	Passive listening	Preselected music by the researcher	individual	Patients' stress hormones, physiologic parameters, pain, and anxiety state during port catheter placement procedures (PCPPs)	State-Trait Anxiety Inventory (p) Visual Analogue Scale (p) Physiological parameters (s)	Before, during and after the procedure	Before and after intervention (exact time not specified)

Figure 1; Search and selection of studies for systematic review according to PRISMA

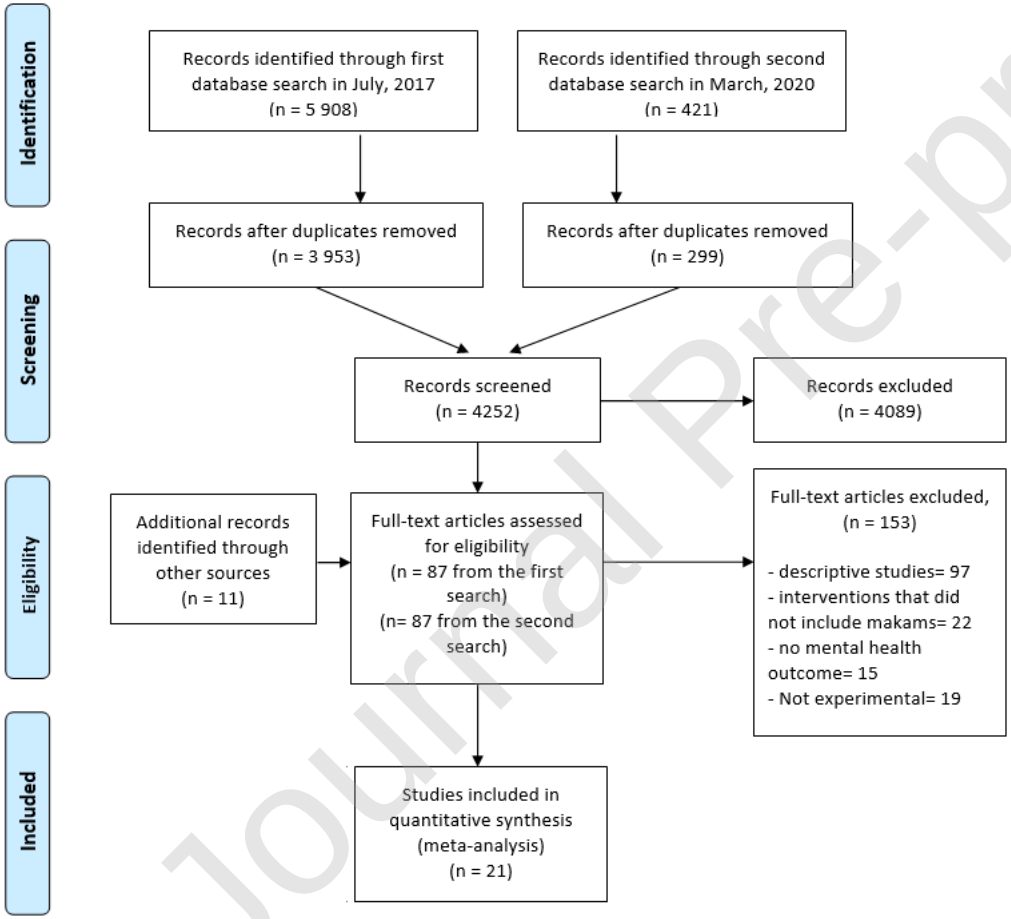

Figure 2; The forest plot and results of meta-analysis of music therapy with makams' effects on anxiety against treatment as usual (TAU)

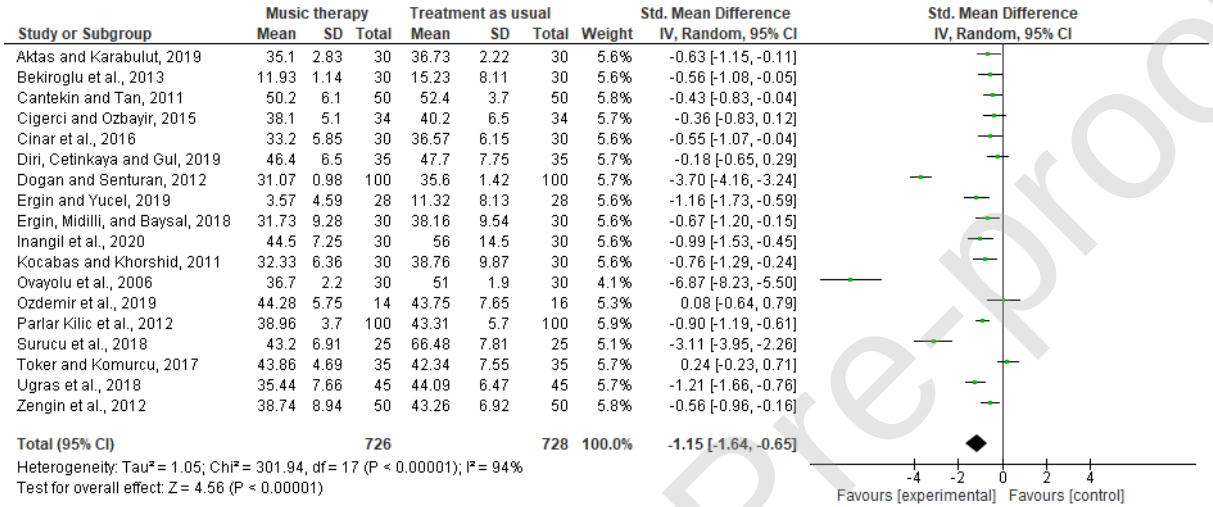

Figure 3; The funnel plot for music therapy with makams' effects on anxiety against treatment as usual (TAU)

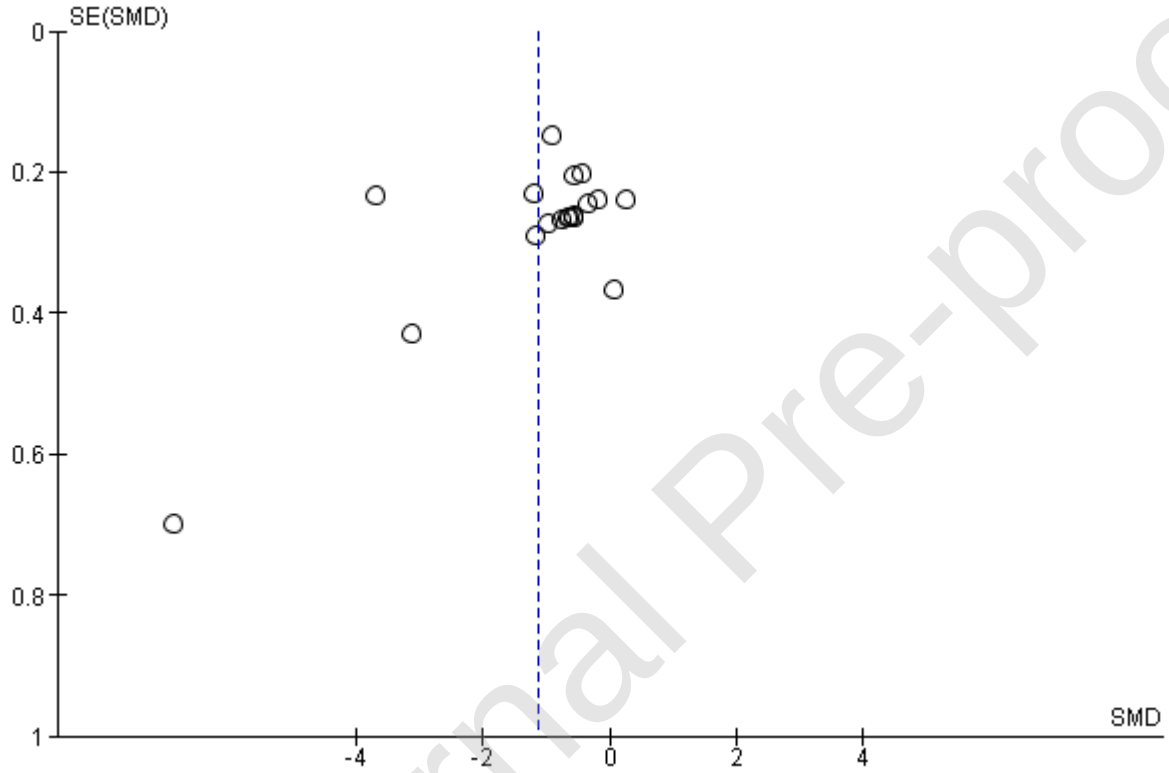

Figure 4; GRADE table for music therapy with makams' effect on anxiety against treatment as usual (TAU)

Certainty assessment							№ of patients		Effect		Certainty
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	music therapy with makam	control	Relative (95% CI)	Absolute (95% CI)	
18	randomised trials	serious	very serious	not serious	not serious	publication bias strongly suspected strong association	726	728	-	SMD **1.15 SD lower** (1.64 lower to 0.65 lower)	⨁◯◯◯ VERY LOW

CI: Confidence interval; **SMD:** Standardised mean difference; **MD:** Mean difference

Figure 5; The forest plot for sensitivity analysis in anxiety including only studies with low risk of bias

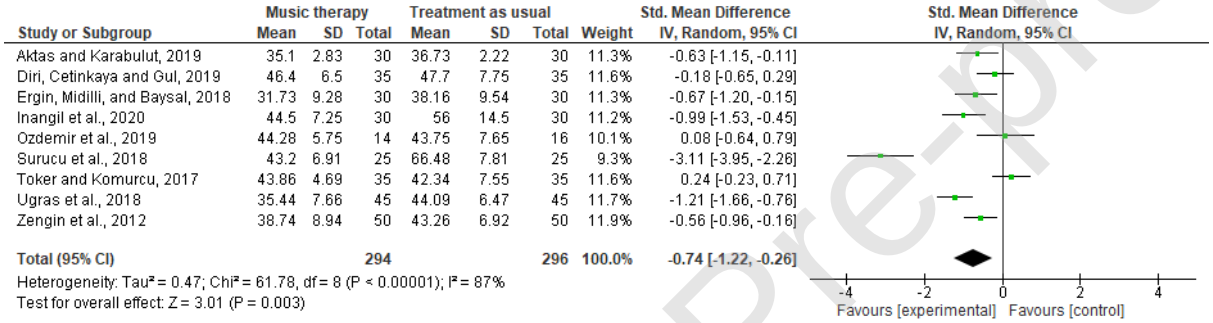

Figure 6; The forest plot and results of subgroup analyses in terms of measured anxiety type

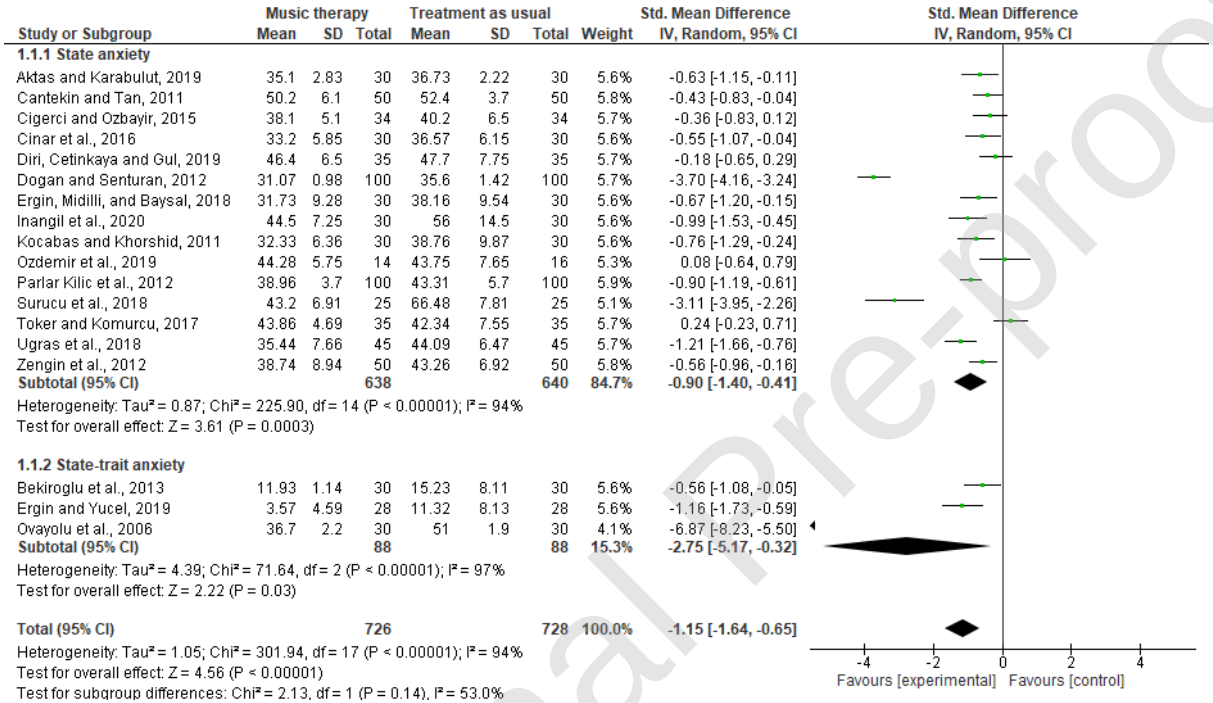

Figure 7; The forest plot and results of subgroup analyses in terms of repetition of music therapy intervention

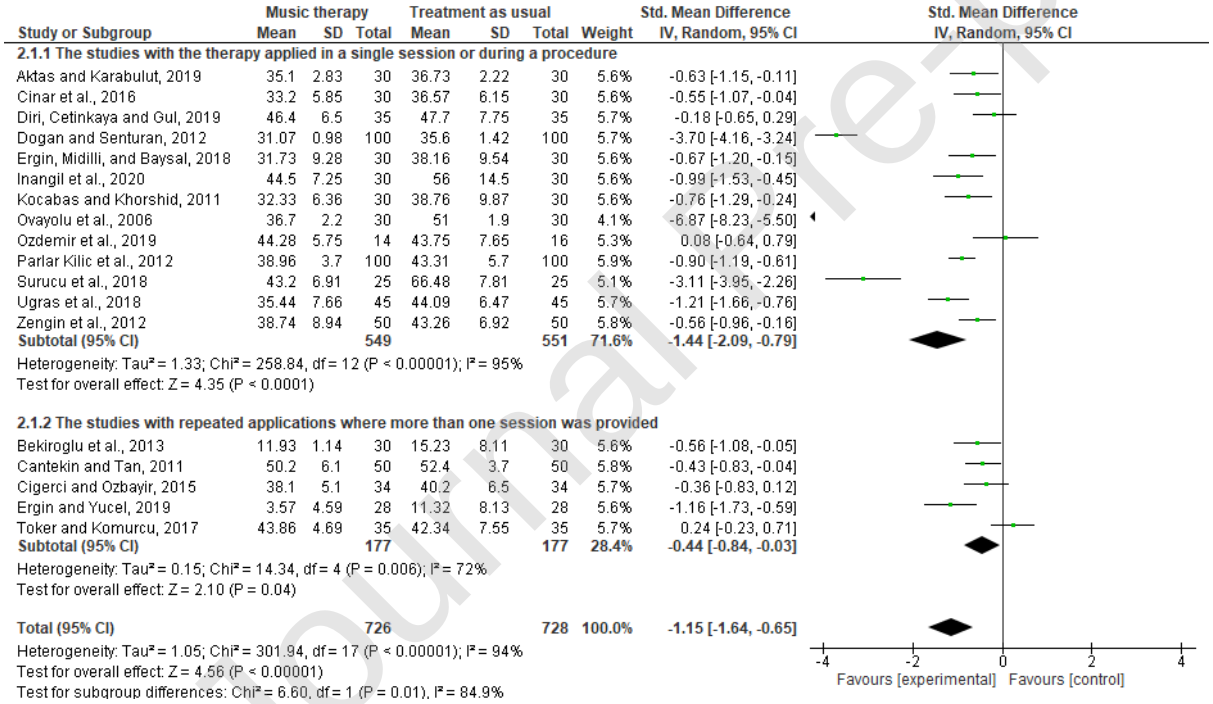

Figure 8; Risk of bias graph: risk of bias percentages across all included studies

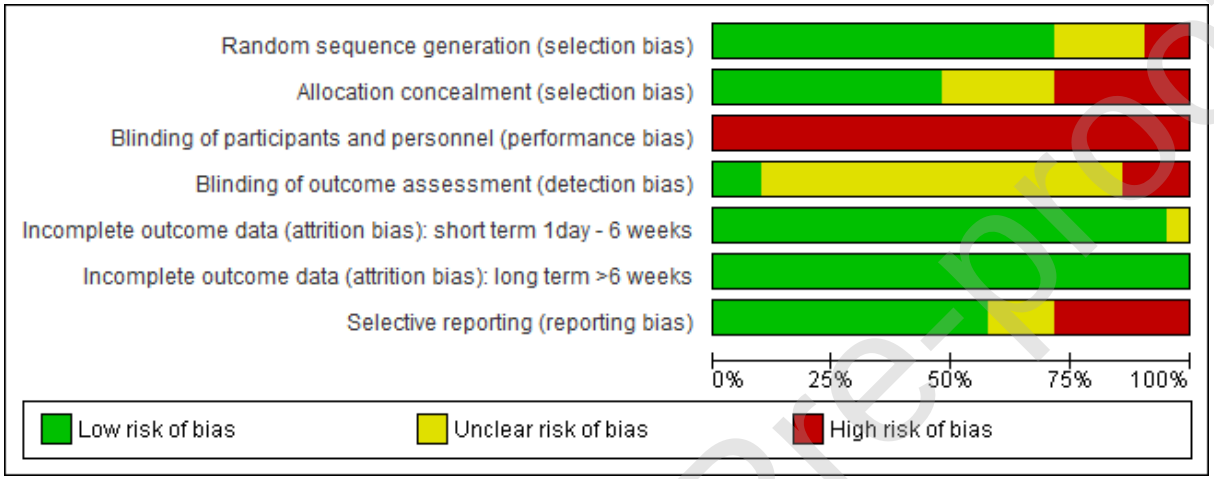

Figure 9; Risk of bias summary: review authors' judgements about each risk of bias item for each included study.