Effectiveness of Indian Classical Raga-Based Music Therapy in the Management of Insomnia: A Systematic Review

Manvi Mahajan[1*], Dr. Meenakshi Chauhan[2], Kusum Punia[3], Vidushi Arya[4]

[1]BA. Psychology (Research Hons.), Department of Psychology, Chandigarh University, Mohali, Punjab, India | Email: manvi.mahajan724@gmail.com (Corresponding Author)

[2]Dr. Meenakshi Chauhan (Ph. D.), Associate Professor, Department of Psychology, Chandigarh University, Mohali, Punjab, India

[3]Kusum Punia, Assistant Professor, Department of Psychology, Chandigarh University, Mohali, Punjab, India

[4]Vidushi Arya, Assistant Professor, Department of Psychology, Chandigarh University, Mohali, Punjab, India

Funding Sources: *"This research received no specific grant from any funding agency"*

ABSTRACT

Background

Insomnia is a prevalent sleeping disorder that comes along with the dysfunctional physical and psychological well-being. Pharmacological treatments are largely used but in the long run, they have long term effects and dependence. The Indian classical music and especially the raga-based music has long been thought to have an effect on the emotional and physiological state that facilitates relaxation and sleep.

Objective

This systematic review was to assess the effectiveness of Indian classical raga music therapy in the treatment of insomnia and to summarize the available evidence on the effects of such music therapy on the outcomes of sleep.

Methods

The review has been done in accordance with the PRISMA guidelines. Electronic databases such as PubMed, Web of Science, Scopus, PsycINFO, and Google Scholar were completely searched. The literature examining the interventions of raga-based music in human subjects with insomnia or sleep disturbances was included. Since studies were heterogeneous in the methodology, data were systematically extracted and synthesized in narrative.

Results

The articles included documented fairly positive effects of raga-based music therapy on the results of sleep. The most popular ragas were Darbari Kanada, Neelambari, Bhairavi and Bageshri. Subjective quality of sleep, the degree of insomnia, and psychological relaxation were improved.

Conclusion

The Indian classical raga-based music therapy seems to offer a hopeful supplement of management of insomnia. Nonetheless, more randomized controlled studies are needed to prove its efficacy in clinical practice and develop standardized treatment procedures.

Keywords: Insomnia, Indian Classical Music, Raga-Based Music Therapy, Sleep Quality, Non-Pharmacological Therapy.

How to cite this article: Mahajan M, Chauhan M, Punia K, Arya V. Effectiveness of Indian Classical Raga-Based Music Therapy in the Management of Insomnia: A Systematic Review. Int J Drug Deliv Technol. 2026;16(59s): 57-70. DOI: 10.25258/ijddt.16.59s.8

Key Points

• This review summarizes the evidence on the use of Indian classical raga-based interventions in the management of insomnia pointing out to their applicability in the use of culturally informed music therapies.
• Evidence suggests that Raga-based interventions have been proposed to have an effect on autonomic regulation involved in the onset of sleep.
• The review is able to determine the critical gaps in research and suggest standard protocols on how the raga will be selected, the duration of the session and outcome measures in subsequent trials.

Source of support: Nil.

Conflict of interest: None

.

1. Introduction

Insomnia is a sleep disorder that is highly widespread in the world and has a great deal of physical, psychological and social implications. The non-pharmacological interventions in the management of sleep disturbance have been in the limelight in consideration of the side effects and chronic dependence linked to pharmacological therapy. Music-based interventions are one of these approaches that have been found as effective as complementary measures to enhance the quality of sleep and enhance relaxation. In this context, the Indian classical music especially raga-based musical compositions have always been assumed to affect emotional and physiological conditions that could help in controlling sleep.

1.1. Insomnia and the Need for Non-Pharmacological Interventions

One of the most common sleep disorders experienced in the world today is insomnia which is a disordered sleep in which one is unable to sleep or stay asleep even after a sufficient sleeptime. According to epidemiological research, around 10-30 percent of adults have chronic signs of insomnia, and this number is higher in older adults and individuals with psychiatric comorbid conditions (Riemann et al., 2017). Chronic insomnia has been linked to such negative physical and psychological consequences as cardiovascular disease, poor cognitive functioning, mood disorders, and poorer quality of life (Baglioni et al., 2016). These effects underscore the significance of effective and safe therapeutic interventions of sleep disorders.

Pharmacological therapy is also one of the prevalent interventions in the treatment of insomnia; nevertheless, extended therapy with hypnotic drugs leads to tolerance, dependence, and other side effects that include daytime drowsiness and cognitive dysfunction (Krystal and Prather, 2019). As a result, the latest clinical guidelines focus on the application of non-pharmacological therapy, such as behavioral therapy, relaxation, and music therapy as the first line of insomnia treatment. Music therapy stands out as one of the approaches to the enhancement of sleep quality in a non-invasive and rather affordable way (Lund et al., 2022).

It has been indicated that music can have an effect on physiological processing of sleep regulation including heart rate variability, autonomic nervous system responses, and emotional arousal (Mukherjee, 2021). According to the experimental research, the responses of the parasympathetic nervous system to the listening to slow-tempo and harmonically balanced music may help to induce relaxation and promote the onset of sleep (Jespersen et al., 2015; Lund et al., 2022). These observations have resulted in increased interest in music genres that are culturally specific, especially Indian classical music, as a source of treatment of sleep disorders.

1.2. Indian Classical Raga-Based Music Therapy

The Indian classical music follows melodic schemes referred to as ragas, which are defined by a given set of notes, mood (rasa), and association of time with specific times of the day. According to the traditional Indian musicology, some ragas have therapeutic qualities that can change the emotional and physiological state. Raga-based healing, in the concept of Raga Chikitsa, is a theory that psychological and somatic states could be changed with the use of auditory stimuli and emotional precipitation by a set of Ragas.

Through the study of raga, music therapists and ethnomusicologists have indicated the ability of ragas to cause a specific emotional and cognitive reactions, which are usually related to calmness, introspection, and relaxation (Brusica, 2014; Grocke and Wigram, 2007; Chang et al., 2012). Empirical studies on the experiences of listeners to raga-based interventions have demonstrated that exposure to ragas can induce a sense of calmness, safety, and introspection among the people who were exposed, which may have certain therapeutic implications in the context of reducing stress and alleviating mental health (MacDonald, 2021; Chang et al., 2012).

There is also evidence of the emotional and neurological effect of raga music through neurophysiological studies. Experiments that have investigated brain activity in response to Hindustani classical music have shown that there is higher activity in the frontal and temporal areas of the brain that deal with the emotional processing and attentional control of the brain with the raga playing tasks (Nayak et al., 2020). The implication of these neural responses is that auditory stimuli in raga can affect those parts of the brain that deal with mood regulation and relaxation; which are very important processes in the sleep-wake cycle (Harmat et al., 2008; Lai & Good, 2005).

1.3 Early Clinical Investigations of Raga-Based Interventions

Gitanjali (1998) conducted one of the first scientific studies to determine the connection between raga music and sleep by unravelling the influence of the Carnatic raga Neelambari on sleep architecture. This was a controlled clinical trial where polysomnographic was measured in eight healthy adult subjects listening to Neelambari raga (intervention) or Kalyani raga (control), respectively. The design of the study was a crossover design where the participants were subjected to both conditions in different nights. Polysomnography was used to

determine objective sleep parameters like sleep latency, REM sleep and non-REM stages.

The researchers stated that the exposure to Neelambari had no statistically significant effects on the sleep structure in comparison to the control raga (Lai & Good, 2005; Chan et al., 2009). The authors however observed that the insignificance of the results might be due to a very small sample size and the lack of statistical power. There were no formal procedures of blinding, and the small size of the cohort made selection bias and measurement bias more likely (Trappe, 2012; Koelsch, 2014, Venkatarangam, S., 2021). Moreover, no reports of drop-outs by the participants were done, which restricts the generalization of the results. In spite of these shortcomings, the research was one of the earliest endeavors to experimentally test the sleep-inducing characteristics of raga music.

Other studies that followed the initial one extended the study of raga interventions in clinical groups. Deshmukh et al. (2009) carried out a randomized controlled trial to determine the impact of Indian classical music in improving the quality of sleep of patients with major depression disorder. Fifty participants were chosen randomly into two treatment groups where one group was a music therapy group with selected ragas in which they were to listen to and the other was a control group where they were given standard hypnotic medication. Validated clinical scales that measured sleep quality and depressive symptoms were the Pittsburgh Sleep Quality Index (PSQI) and the Montgomery Asberg Depression Rating Scale (MADRS).

The analysis demonstrated that there were a lot of improvements in the quality of sleep among the participants who were subjected to the raga-based music therapy and the results were similar to the group that received the pharmacological treatment (Krishnamurthy & Rao, 2025; Banerjee et al., 2017). The participants were assigned to treatment groups randomly; thus, it was not possible to blind the treatment because of the intervention. The authors did not ignore the possibility of bias due to the lack of participant blinding and comparative follow-up time. However, the results indicated that Indian classical music can be used as adjunctive treatment of sleep disorders in psychiatric diseases (Johnson, 2003; Allen & Blascovich, 1994).

1.4. Emerging Evidence from Contemporary Studies

More recent work has gone on to investigate the therapeutic value of raga-based interventions to a wider range of populations. A quasi-experimental trial of the impact of Raga Darbari Kanada on the elderly with psychological distress showed that there were significant decreases in the severity of insomnia after an eight-week music therapy intervention (Nilsson, 2008; Su et al., 2013). The participants were asked to listen to instrumental performances of the raga every day before sleep, and the results of sleep were determined with the help of Insomnia Severity Index (ISI). The researchers reached statistically significant results of sleep parameters improvement in weeks four and eight after intervention.

Nonetheless, the research used a single-group pre-after study but did not use a control group that would allow attributing positively changes to the intervention only. The randomization and the blinding procedures were not conducted, which could introduce the selection bias and the effects of expectations. Also, there is no reported drop-out rates, which restricts the evaluation of the bias of attrition. Such methodological shortcomings notwithstanding, this study presented first-time evidence in favor of the possible impact of raga-based interventions to enhance sleep in aged cohorts (Sanyal et al., 2016; Jespersen et al., 2015).

In the same way, a clinical study on the effect of Carnatic raga-Bilahari as a caregiver support method to reduce sleep disturbances and anxiety in cancer patients displayed a significant decrease in sleep disturbances, anxiety in one month of frequent listening sessions. The intervention involved listening to vocal and instrumental performances of the raga 15-30 minutes a day 5 days a week. The level of sleep disturbance was also significantly lower after the intervention period. Even though the researchers have used a set of standardized screening tools and structured intervention sessions, the sample size has been selected by means of purposive, but not randomized sampling, and the design lacks the element of blindness, contributing to the occurrence of performance bias. However, the results indicate that raga based music therapy can probably produce positive outcomes on sleep related effects on psychologically stressed populations.

In more recent times, the research of raga-based interventions with the help of immersive environments has become possible with the help of technological progress (Thoma et al., 2013; Chanda & Levitin, 2013). In a randomized experimental research conducting investigations of the psychophysiological impact of Raga Bhairavi, forty four people were randomly grouped either in a virtual reality based raga listening intervention condition or in a control condition. The paper has documented decreases in stress-related physiological measures and increases in heart rate variability of people who were exposed to the raga-based intervention. Internal validity was enhanced by random allocation but participant blinding was not practiced because of the immersive component of the intervention. The authors further

indicated that short duration of intervention and less follow-up was a possible basis of bias.

Besides these clinical studies, new neurophysiological studies have been done on the possible sleep inducing properties of certain ragas . The results of a pilot electroencephalography (EEG) study of Raga Puriya Dhanashree showed an augmentation of theta and delta wave activity when exposed to music, as they are neural patterns that are commonly linked to sleep and relaxation (Loewy et al., 2013). Though the sample was small (six participants) and the study was not randomized, the results of the study present the initial evidence that raga music can have an impact on the neural mechanisms related to sleep regulation.

1.5 Research Gap and Rationale for the Present Review

Even though, music therapy has gained prominence as a viable non-pharmacological approach to the treatment of sleep disorders, the role of the Indian classical raga-based music therapy in management of insomnia is under-researched. A number of experimental and clinical studies have proposed that the listening to the chosen ragas can be followed by relaxation, alleviation of psychological stress, and an enhanced quality of sleep (Deshmukh et al., 2009; Jespersen et al., 2015). Nevertheless, the current literature is extremely disjointed and differs significantly in terms of methodological quality, format of intervention, and measurement of outcome. Most of the existing literature has small sample sizes, inappropriate randomizing or blinding methods, and in most cases, they have heterogeneous intervention protocols such as ragas, length of listening and modes of delivery. This methodological heterogeneity complicates the making of strong conclusions on the clinical efficacy of the raga-based music therapy on insomnia.

Moreover, although various narrative reviews and single experimental studies have been conducted on the therapeutic role of music therapy as a sleep-enhancing intervention, a systematic synthesis on the therapeutic role of Indian classical raga-based interventions has not been done so far. Unless a systematic review of the available evidence is conducted, the clinicians and researchers find it difficult to ascertain the reliability, applicability, and therapeutic usefulness of these interventions. Thus, the systematic review that follows the PRISMA guidelines is required to critically discuss the existing evidence, find the strengths and weaknesses of the methodology, and give a holistic perspective on the efficacy of the raga-based music therapy in the treatment of insomnia.

1.6. Objective of the Study

Even though, music therapy has gained prominence as a viable non-pharmacological approach to the treatment of sleep disorders, the role of the Indian classical raga-based music therapy in management of insomnia is under-researched. A number of experimental and clinical studies have proposed that the listening to the chosen ragas can be followed by relaxation, alleviation of psychological stress, and an enhanced quality of sleep (Deshmukh et al., 2009; Jespersen et al., 2015). Nevertheless, the current literature is extremely disjointed and differs significantly in terms of methodological quality, format of intervention, and measurement of outcome. Most of the existing literature has small sample sizes, inappropriate randomizing or blinding methods, and in most cases, they have heterogeneous intervention protocols such as ragas, length of listening and modes of delivery. This methodological heterogeneity complicates the making of strong conclusions on the clinical efficacy of the raga-based music therapy on insomnia.

Moreover, although various narrative reviews and single experimental studies have been conducted on the therapeutic role of music therapy as a sleep-enhancing intervention, a systematic synthesis on the therapeutic role of Indian classical raga-based interventions has not been done so far. Unless a systematic review of the available evidence is conducted, the clinicians and researchers find it difficult to ascertain the reliability, applicability, and therapeutic usefulness of these interventions. Thus, the systematic review that follows the PRISMA guidelines is required to critically discuss the existing evidence, find the strengths and weaknesses of the methodology, and give a holistic perspective on the efficacy of the raga-based music therapy in the treatment of insomnia.

2. Methodology

The current systematic review was done to determine the efficacy of Indian classical raga-based music therapy in the treatment of insomnia. The reporting strategy was based on the PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) to provide the transparency, reproducibility and methodological diligence. PRISMA guidelines offer a standard methodology on how to locate, filter, and forge research findings in systematic reviews. The review involved extensive search in the literatures, the predefined eligibility criteria, systematic selection of studies, data extraction, and qualitative synthesis of selected studies.

2.1 Search Strategy

A systematic and extensive literature review was performed to determine the studies that were relevant in the analysis of the impacts of Indian classical raga-based music therapy on the outcomes of insomnia or sleep. The search of multiple electronic databases was done to cover as much of the available literature as

possible. PubMed, Scopus, Web of Science, PsycINFO, and Google Scholar were the main databases. These databases were chosen on the basis of indexing of the key publications concerning music therapy, sleep medicine, psychology, and complementary medicine.

A combination of keywords and Boolean operators were used to develop the search strategy that was able to find studies that are relevant to the research topic. The major search terms were combinations of words that were associated with music therapy, Indian classical music, ragas, and insomnia. The keywords were the following: Indian classical music, raga therapy, raga-based music therapy, music therapy, sleep disorders, insomnia, sleep quality and sleep regulation. The search results were refined by using Boolean operators like the word AND and OR. Search terms such as: (Indian classical music) OR (raga therapy) AND (insomnia) OR (sleep disorder) OR (sleep quality) were used as search terms (Table 1). The reference lists of the relevant articles were also screened manually to ensure that they had other studies that showed could not be found using the database. Peer-reviewed articles written in English were the only ones to be included in this review.

Concept	Search Terms Used
Insomnia	"insomnia" OR "primary insomnia" OR "chronic insomnia" OR "insomnia disorder"
Music Intervention	"music therapy" OR "music-based intervention" OR "music listening" OR "auditory stimulation"
Indian Classical Context	"Indian classical music" OR "raga" OR "ragas" OR "raga therapy" OR "Hindustani music" OR "Carnatic music"
Study Design	"randomized controlled trial" OR "clinical trial" OR "systematic review" OR "meta-analysis"
Combined Strategy	Insomnia AND Music Intervention AND (Indian classical OR raga)

Table 1: Keywords Used in Database Searches

2.2 Inclusion and Exclusion Criteria.

To achieve uniformity in the selection of the studies, the screening process was done through setting up of eligibility criteria. The studies needed to be included in the review based on the following criteria: (1) original research articles examining the effects of Indian classical music or raga-based interventions; (2) studies that involved human participants with insomnia or sleep-related disturbance; (3) experimental, quasi-experimental, randomized controlled trials, or observational studies reporting any measurable outcome related to sleep (Table 2).

This was in case any of the following criteria were met: (1) review articles, editorials, commentaries, or conference abstracts, where there was no complete data provided; (2) studies that studied general music listening and not specific reference to Indian classical ragas, and (3) studies that did not measure the outcomes related to sleep; (4) non-English studies; and (5) studies that were done on animal models (Table 2). The criteria were used to guarantee that the review targeted the empirical studies investigating the raga-based music interventions as a source of insomnia.

Domain	Inclusion Criteria	Exclusion Criteria
Study Structure	Clinical Trials, Controlled Trials, Systematic Reviews, Meta-Analyses	Editorials, commentaries, case reports, conference abstracts without full text
Population	Human participants diagnosed specifically with insomnia	Animal studies; studies not isolating insomnia as the primary diagnosis
Intervention	Music-based interventions including Indian classical raga therapy	Studies without music intervention; multimodal interventions where music effects are not separable
Terminology	Explicit use of "insomnia" or recognized insomnia diagnosis	Studies using only "sleep disturbance" or "sleep disorders" without specifying insomnia
Timeline	Published between 1995 and 2025	Studies published before 1995

Table 2: Parameters for Study Selection

2.3 Study Selection Process

The selection of the study was based on the four-stage PRISMA-recommended literature selection framework, including identification, screening, eligibility assessment, and inclusion. In the identification stage, all records which were retrieved in all the databases selected were exported to a reference management system and duplicated records were eliminated. During the screening phase, titles and abstracts of the retrieved studies were used to decide whether they were relevant to the research topic. At this point, studies that were evidently not included in the inclusion criteria were filtered out.

After the initial screening, the entire texts of the rest of the articles were evaluated regarding eligibility. All of the articles were assessed in regard to predefined inclusion and exclusion criteria. Only those studies that met all the eligibility criteria were reviewed. Causes of exclusion in the full-text stage were recorded to ensure that the selection process is transparent. The whole selection process was condensed in PRISMA flow diagram that represented the number of records found, filtered, filtered out, and included in the final analysis.

2.4 Data Extraction

Systematic data extraction was conducted by using a standardized data extraction form which was created specially to be used in this review. This step was designed to retrieve the appropriate methodological and outcome information in each of the included studies in a similar fashion. Data taken out of each study were the author(s), year of publication, country of study, study design, characteristics of the participants, sample size, type of raga or music intervention, duration and frequency of the intervention, as well as, outcome measures that were used to measure the quality of sleep.

Other methodological details were also obtained such as the existence of randomization protocols, blinding strategies, and loss or drop-out rates of the participants. This information was significant in the evaluation of the quality of methodology and possible bias of included research studies. Statistical outcomes and the main findings in regard to the sleep outcomes were also be extracted where available in order to be further synthesized.

2.5 Data Synthesis

The data analysis was conducted using a narrative synthesis method because the expected heterogeneity of the studies was likely to differ in research design, intervention protocols and outcome measures. In cases where quantitative meta-analysis cannot be done, the systematic organization and interpretation of findings can be done using narrative synthesis. The obtained data were summarized on the table first in order to get a preview of the nature of included studies.

The results were then discussed and classified on the basis of major themes, such as the form of ragas applied in therapy, the length of the intervention, the population of the participants, and the effect on sleep parameters of sleep quality, sleep latency, and the severity of insomnia. The methodological issues were of specific interest, including randomization, the blinding procedures, and the possibility of bias because these issues affect the validity and reliability of the reported results.

The aim of the synthesis was to unravel the similarities and deviation among studies and to point out the merit and demerit of the available evidence. In this way, it was possible to thoroughly examine the existing level of research on the topic of raga-based music therapy in the context of insomnia and realize the gaps that should be filled with more in-depth research in the future.

3. Results

The findings of the systematic review were provided in accordance with the PRISMA (Preferred Reporting Items the Systematic Reviews and Meta-Analyses) framework. The results summarize the research selection process, the nature of the studies that were included, the nature of the rag-based interventions, the effects that were reported on insomnia and sleep outcomes, and the methodological quality of the included ones.

3.1 Study Selection

A total of 330 records in all the chosen electronic databases such as PubMed, Scopus, Web of Science, PsycINFO, and Google Scholar were identified in the initial search of the database. Following the elimination of all the duplicate records, 268 distinct articles were left to go through the screening process. The screening step of the title and abstract led to the removal of 214 studies since they could not comply with the set inclusion criteria, the main reason being their lack of focus on raga-based interventions or sleep-related outcomes (fig.1).

The rest of the 54 articles were screened through full-text eligibility. At this step, some of the studies were dismissed due to the following reasons: they employed general music therapy and did not mention Indian classical ragas, could not measure the results of sleep, or lacked methodological details. After the full-text review, 15 studies were found to fit all the eligibility criteria and they were incorporated in the final qualitative synthesis.

The PRISMA flow diagram was used to record the study selection process, and was represented as a number of reviewed studies identified, screened, excluded, and included.

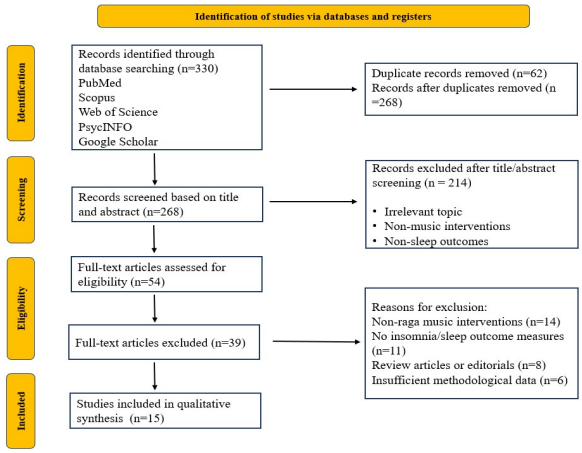

Fig.1: Source Evaluation of resources

3.2 Characteristics of Included Studies

The studies used were carried out in different geographical locations, such as in India, the United States, and various European countries. The majority of the studies were published in the period between 1998 and 2024, which indicates the growing interest in the treatment uses of Indian classical music. The research designs were relatively different and they were randomized controlled trials, quasi-experimental studies, pilot clinical trial, and observational studies.

The range of sample sizes used in studies was between 6 and about 100, and the population in which the participants were sampled included healthy adults, older patients, patients with depression, and individuals who had to deal with psychological stress as caregivers. The interventions used were normally listening to recorded or live concerts of certain ragas of periods between 15-60 min each session, the duration of interventions between two weeks up to eight weeks.

Validated clinical instruments to test the changes of sleep related factors were the outcome measures like the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), and polysomnographic measures in some experimental studies. Associated psychological outcomes, such as mood states, anxiety, and stress, were also measured in several studies.

3.3 Types of Ragas Used in Therapeutic Interventions

Some of the ragas which were commonly used in therapeutic situations to induce relaxation and enhance sleep quality were highlighted in the review. The most popular ragas that were reported were Darbari Kanada, Neelambari, Bageshri, Yaman and Bhairavi. These ragas are customarily linked with harmony, meditative attitude, late-evening or nighttime recitation, which are considered to help to relax and induce sleep.

One such example is Neelambari which is a Carnatic raga traditionally linked to lullabies and sleep induction, but one of the earliest experimental studies explored its action on sleep architecture. Equally, Darbari Kanada, a Hindustani raga, which is slow-tempo and deep-toned has been applied in clinical trials to alleviate the symptoms of psychological stress and insomnia. There are other ragas like Bhairavi that have been researched on their capacity to lower physiological stress markers and stimulate the activity of the parasympathetic nervous system.

Such ragas have some similar musical features including slow rhythmical motifs, low-frequency tonal designs as well as mood-soothing melodic sequences, which can be the causes of their possible therapeutic qualities.

3.4 Effects of Raga-Based Music Therapy on Sleep Outcomes

Within the gathered research, the raga-based music therapy showed overall positive results in terms of sleep-related outcomes. A number of studies reported that after the exposure to raga-based interventions, the sleep quality improved, the sleep latency went down and the sleep duration increased, and the severity of insomnia decreased.

Clinical trials that were conducted on subjects with depressive disorders indicated a high level of improvements in the sleep quality scores following consistent exposure to the Indian classical music interventions. Equally, interventions that used older individuals showed that severity of insomnia and subjective quality of sleep had reduced in the course of a few weeks following the raga listening sessions.

Physiological-based experimental research also indicated that raga-based music has the potential to affect the activity of the autonomic nervous system that leads to the end result of low heart rate and stress response, and increased relaxation. Such physiological alterations have been said to help the body pass the state of wakefulness into sleep hence helping in the achievement of better sleep.

The magnitude of the reported effects however differed among the studies probably because of the differences in the design of the studies, the characteristics of the participants and the intervention procedures. A small number of pilot studies have demonstrated small or inconclusive outcomes especially when the sample size was small or there was limited intervention time.

3.5 Methodological Quality and Risk of Bias

The quality of methodology of the studies utilized was quite different. The fact that only a few studies used randomized controlled trial studies, with well-presented allocation procedures strengthened the internal validity of the findings thereof. Nevertheless, some studies used quasi-experimental or single-group designs without control groups, which did not provide

an opportunity to determine the causal correlation between intervention and sleep outcomes.

Blinding was often not carried out because the nature of the music therapy interventions is such that the participants are usually not unaware of the type of treatment they are getting. Lack of blinding is subject to performance and expectancy bias which may affect the participant-reported results.

Also, a few studies had sample sizes relatively small that could decrease the statistical power and the probability of type II error. The consequences of attrition bias were not completely measured as there was no consistency in the reporting of the attrition rate and the drop-out rate among the studies.

Irrespective of these shortcomings, most of the studies revealed trends of consistency to indicate positive effects of raga-based music therapy on sleep-related parameters. However, methodological heterogeneity and biases that can be noticed in the studies indicate that larger, well-designed randomized controlled trials are needed in order to develop a more robust evidence of the therapeutic efficacy of raga-based interventions.

3.6. Thematic Analysis of Findings

The thematic analysis was applied to the collected studies to determine the common patterns in the reported results of the raga-based music therapy in insomnia. According to the synthesis of the chosen studies, some important themes were identified, namely, an increase in the quality of sleep, a decrease in the severity of insomnia, the physiological effect of relaxation, and the psychological effect of reducing stress. The combination of these themes demonstrates that there are possible mechanisms by which Indian classical raga-based music therapy can be used to aid in the control of sleep.

Theme 1: Improvement in Subjective Sleep Quality

Among the most often described themes in the studies included, there was the increase of subjective sleep quality after being exposed to the music therapy based on raga music. A number of the studies have documented the substantial decrease in the severity of insomnia and the increases in the levels of sleep quality assessed by valid instruments.

As an illustration, Deshmukh et al. (2009) tested the response of the Indian classical music therapy on the depressed patients who had sleep disturbances. The research found that the participants whose sleep quality was tracked with the help of the Pittsburgh Sleep Quality Index (PSQI) showed substantial increases in the quality of their sleep when they listened to Indian classical ragas in comparison with the baseline scores. On the same note, Pareek and Shekhawat (2022) noted that four weeks of exposure of Raga Darbari Kanada led to substantial improvements in the severity of insomnia and sleep quality in adults who were exposed. According to these findings, frequent listening to calming ragas can lead to the observed changes of perceived sleep quality and nighttime restfulness.

Besides this, the use of music interventions on insomnia has also been found to yield similar effects on the sleep quality among the various groups. As an example, a systematic review by Jespersen et al. (2015) found that the listening to relaxing music before bedtime improved significantly the quality of sleep among adults with symptoms of insomnia. Despite the fact that the types of music investigated in that review were various, the outcomes confirm the possibility of the structured musical interventions like the raga- based therapy in sleep control. The cumulative results can be taken to point to the potential of Indian classical music as a helpful complementary intervention to enhance subjective sleep outcomes.

Theme 2: Reduction in Psychological Stress and Emotional Arousal

The second common theme that was found in the studies that were incorporated was the decreased psychological stress and emotional arousal which are some of the contributors of insomnia. Various research studies reported a reduction in stress, anxiety and emotional distress after listening to raga music.

As an illustration, Pareek and Shekhawat (2022) found that individuals that received Raga Darbari Kanada had a substantial decrease in their levels of stress and anxiety because of a well-organized music therapy treatment. On the same note, a study conducted on the caregivers of cancer patients showed that the psychological stress when listening to Carnatic raga Bilahari was notably lowered which also enhanced the quality of sleep. These results imply that raga-based music can be used to induce emotional relaxation, thereby, induce sleep.

This correlation between relaxation and better sleep outcomes is supported by music therapy research in general. Research has also shown that relaxing music can lower physiological indicators of stress including heart rate and cortisol concentrations and induce a condition favorable to sleep (de Witte et al., 2020). Distinct emotional and meditative characteristics of Indian classical ragas can thus put forward as a contributor of the insomnia alleviation by the stress reduction mechanism.

Theme 3: Physiological Relaxation and Autonomic Nervous System Regulation

A number of investigations pointed also at the influence of physiological relaxation and the alteration of the autonomic nervous system as the mechanisms of the sleep-promoting effect of raga-based music therapy. Slow-tempo music with a constant melody has been found to stimulate parasympathetic nervous system and deactivate sympathetic arousal.

In the experimental studies involving the impacts of Indian classical music on physiological reactions, it has been noted that heart rate decreased and the heart rate variability increased during the raga listening sessions (Chand, K., et al., 2024). Relaxation and better onset of sleep have been linked to increased parasympathetic activity. Moreover, previous experimental studies have indicated that the exposure to certain ragas can have an effect on the activities in the brain related to relaxation and sleep onset (Gitanjali, 1998).

These findings are further backed up by evidence of other studies of music therapy. According to Jespersen et al. (2015), a music intervention can be used to help to shorten latency to sleep and induce physiological states that are conducive to sleep through relaxation. Overall, these results indicate that raga-based music therapy could help to enhance sleep with the help of neurophysiological mechanisms related to autonomic regulation and relaxation.

Theme 4: Methodological Variability Across Studies

The last theme that was determined during the review was the methodological diversity between the available studies on raga-based music therapy. The studies that were included varied in many aspects in the way of sample size, study design, duration of intervention and outcome measure. Some of the studies used experimental or randomized, whereas other ones used quasi-experimental or observational design.

An example is Gitanjali (1998), which is a laboratory-based experimental study that used polysomnographic measures but the sample size was very small and thus not generalizable. Deshmukh et al. (2009), on the other hand, used a larger sample of clinical subjects but did not provide any participant blinding because of the characteristics of the intervention. These differences in the research methodology complicate direct comparisons between the studies and recommend more standardized research protocols.

However, regardless of the variability in methods, most of the studies reported a consistent improvement in the outcomes of sleep-related aspects after the raga-based interventions. The fact that the same findings were reached in many different study designs makes the overall conclusion that Indian classical music therapy could be used therapeutically to manage insomnia.

4. Discussion

The aim of the current systematic review was to assess the usefulness of the Indian classical raga-based music therapy in insomnia treatment through the synthesis of findings based on clinical and experimental studies available. The review established the emergence of a much literature that has explored the therapeutic possibilities of Indian classical music in enhancing the quality of sleep, diminishing the severity of insomnia, and enhancing the physiological relaxation. Despite the differences backgrounds of the studies included, i.e. in research design, intervention procedures, and population of the participants, most of them reported positive effects of raga-based interventions on sleeping-related outcomes. The summary of the main findings of the review are discussed below and the implications are evaluated with respect to clinical practice and future research.

4.1 Summary of Included Studies

A number of the studies incorporated in this review have examined therapeutic potential of the Indian classical raga-based music to enhance sleep quality of subjects and symptom reduction of insomnia in various subjects (table 3).

In this study, Gitanjali (1998) used a population of eight healthy adult participants in India to conduct an experimental study to investigate the impact of Carnatic raga Neelambari on sleep architecture. Individuals were subjected to polysomnographically controlled sleep on raga music recording. The intervention was performed in laboratory sleep records, and such outcomes as the sleep latency and sleep stages were measured. No notable difference of objective sleep architecture was found, but the participants were subjectively relaxed.

In a clinical study conducted by Deshmukh et al., (2009), 50 patients with depression and related sleep disturbances were used in the study in India. Intervention group people were exposed to Indian classical music every day in a three months music therapy program where the control group was treated with regular pharmacological treatment. The Pittsburgh Sleep Quality Index was used to measure the quality of sleep. It was discovered that there were significant differences in sleep quality of participants that were involved in the music intervention.

The study by Pareek and Shekhawat (2022) was quasi-experimental and was carried out in India and with the participation of 60 adults who had psychological stress and sleep problems. Raga Darbari Kanada was played to the participants at about 20-30 minutes a day and a span of four weeks. The intervention led to the decrease in insomnia severity and the improvement of the quality of sleep.

In another study carried out in India among 30 caregivers of the cancer patients, a study was done to determine the impact of Carnatic raga Bilahari on sleep disturbances. Those sampled were taking part in daily sessions of listening, which lasted 15-30 minutes, during one month. The researchers found that there were great results in the quality of sleep and decreases in stress.

In a similar manner, Chand, K., et al. (2024) examined psychophysiological impacts of Raga Bhairavi in 44 participants who were adults and conducted the study in the form of structured listening. The short-term intervention showed lower levels of indicators of physiological stress and enhanced relaxation responses that could assist in the improvement of sleep regulation.

Generally speaking, these studies can imply that the exposure to the Indian classical ragas might lead to the increase in the quality of sleep and psychological relaxation, but methodological inconsistency of the studies suggests that additional well-designed clinical trials are necessary.

Study	**Country**	**Sample**	**Intervention**	**Duration**	**Outcomes**
Gitanjali (1998)	India	8 healthy adults	Introduction to Carnatic raga Neelambari under polysomnography monitored sleep.	Conducted during laboratory sleep recordings	There was no significant change of objective sleep architecture, but subjective relaxation was found.
Deshmukh et al. (2009)	India	50 patients with depression and sleep disturbances	The comparison of music therapy involving daily listening to Indian classical music and pharmacological intervention.	3 months	A considerable increase in the quality of sleep as assessed by Pittsburgh Sleep Quality Index (PSQI).
Parek & Shekhawat (2022)	India	60 adults experiencing psychological stress and sleep disturbances	Raga Darbari Kanada listening session as a structured music therapy intervention.	20–30 minutes daily for 4 weeks	Decrease in the level of insomnia and increase in sleep quality.
Study on caregivers of cancer patients	India	30 caregivers experiencing stress and sleep disturbances	Listening to Carnatic raga Bilahari during organised music therapy.	15–30 minutes daily for 1 month	Better quality of sleep and less stress.
Chand, K., et al. (2024)	India	44 adult participants	Music Raga Bhairavi exposure in organized listening tests measuring psychophysiological responses.	Short-term experimental sessions	Less physiological stress predictors and better relaxation reactions connected with sleep management.

Table 3: Summary of key studies

4.2 Possible Mechanisms of Raga-Based Music Therapy in Sleep Regulation

The raga-based music therapy on insomnia can be attributed to a number of physiological and psychological processes to explain its therapeutic

effects. The modulation of the autonomic nervous system is one of such mechanisms. Music of slow tempo and relatively stable melody was also found to be associated with enhancement of the activity of the parasympathetic nervous system and a decrease in sympathetic arousal resulting in a reduction in heart rate and better relaxation. These are the physiological adaptations that help in inducing the sleep state, after being awake.

The other mechanism that may have been used is in the regulation of emotion and stress. Insomnia has been reported to be linked with increased arousal of the mind, anxiety, and stress. The music based on Raga and which is organized in terms of certain melodic patterns and emotional expressions can create soothing emotional effects that mitigate the psychological tension and facilitate the mental relaxation. Research into the effect of exposure to the Indian classical music on emotional reactions has indicated a heightened level of tranquility and a decrease in anxiety levels after listening to specific ragas.

Neurophysiological research also indicates that there could be an effect of music listening on the brain activity related to sleep onset. Electroencephalographic studies have demonstrated that relaxing music is able to enhance the activities of alpha and theta brain waves which are brain patterns that are linked to relaxation and sleeping onset. The implications of these results are that the music based on the raga can help the neurophysiological activities to induce sleep.

4.3. Comparison with Other Music Therapy Interventions

Results of this review are in line with other studies that have investigated the impact of music therapy on the quality of sleep. Western classical music and relaxing instrumental music studies have shown that there is an improvement in the sleep latency, sleep efficiency and quality of sleep in both clinical and healthy population. The music based on the raga of Indian classics is however unlike most Western music interventions as it has a defined melodic system that is connected with the particular emotional conditions and the time of the day.

They may be attributed to the therapeutic potential of the notion of chronobiological associations of ragas, according to which certain ragas are traditionally played at a certain time of the day or night. Evening ragas like Darbari Kanada and Bageshri are stereotypically connected with a sense of calmness and introspection which can make them more appropriate in sleep-related therapy.

4.4. Clinical Implications

The results of this systematic review indicate that Indian classical raga-based music therapy can be used as a promising complementary form of intervention in clinical management of insomnia. Considering the rising popularity of sleep disorders and the constraints of long-term pharmacological interventions, alternative strategies that could be applied in clinical practice to enhance sleep outcomes include the use of non-pharmacological strategies, including music therapy.

The fact that the raga-based music therapy is non-invasive and low-cost is one of the most significant benefits of this approach. In comparison to pharmacological interventions, music-based interventions have no risks of dependency, tolerance, and adverse side effects. This renders them specifically applicable in the long-term use of people who have to constantly address sleep disturbances. Clinicians and mental health workers can thus prescribe the process of organized listening to pacifying ragas as one of the behavioral sleep management methods.

Raga-based music therapy could also be used in the clinical setting in the context of the insomnia case that is part of the integrative treatment programs. In one instance, an example of behavioral interventions that can be integrated with music listening sessions may include sleep hygiene education and cognitive behavioral therapy of insomnia (CBT-I). It is possible that listening to slow-paced ragas before sleeping can lower cognitive arousal and induce relaxation as well as adaptation to sleep. Ragas traditionally linked to the state of peace and night performance, including Darbari Kanada, Bageshri and Neelambari, might be especially helpful in terms of therapeutic application in inducing sleep.

The application of raga-based music therapy to special populations is another significant implication of the research that can be made, such as older adults, depressed or anxious patients, or caregivers who have been living under chronic stress. The prevalence of sleep disturbances in these groups is usually high, and the music therapy can provide a culturally meaningful and psychologically meaning intervention to enhance the quality of sleep and emotional well-being.

Lastly, the availability of online music systems can make raga-based therapy easily applicable in the realm of self-care in the home setting, which further increases its applicability to clinical settings. Professionals can prescribe regular listening schedules as individual sleep enhancement techniques. All in all, raga-based music therapy is a viable alternative treatment that can be used to complement holistic and patient-centered approach to management of insomnia.

4.5. Limitations of Existing Studies

Although the results of the studies were promising, a number of weaknesses in the available literature were found. Most of the researches were small in sample and thus restrict the findings in generalization. Besides that, some of the studies were quasi experimental designs that lacked the use of control groups, and therefore, it was hard to determine causation between intervention and the results achieved.

The other limitation is that there are no standard intervention protocols. The different studies were diverse in nature on the ragas employed, the time of listening, frequency of intervention, and the measure of outcomes. This inconsistency complicates the comparative analysis of the results between studies and the identification of the most efficient treatment plans.

Moreover, most of the studies do not apply any forms of blinding, thus leaving the expectancy bias, especially when self-reported sleep scales are used to assess outcomes.

5. Future Research Directions

Although the results are positive, the current body of research on the use of Indian classical raga-based music therapy to address insomnia is limited and methodologically diverse. The research in the future ought to involve carrying out randomized controlled trials at a large scale to create more solid causal information about the efficiency of using raga-based interventions to promote a better sleep quality. Small sample sizes and quasi-experimental research designs characterize many of the recent studies and restrict their generalizability of the findings.

Standardized intervention protocols (such as guidelines on what ragas to use, when and how much of the intervention should be applied, and at what time of the day the intervention should take place, e.g., bedtime listening) are also needed. This would enhance comparability among studies and aid in coming up with clinical recommendations to be used in therapy.

Further research must also use objective measures of sleep outcomes by involving polysomnography or actigraphy as well as subjective sleep questionnaires such as those used by the Trevis et al. (2016) study. Additional interdisciplinary researches on the topic of combining music therapy with neuroscience and sleep studies can contribute further to the insight into the physiological and neurological processes involved in music based on raga affecting sleep regulation. Lastly, the studies with a greater and more varied population will be used to identify the long-term effectiveness and clinical applicability of the raga-based music therapy to manage insomnia.

6. Conclusion:

This systematic review paper attempted to review the effectiveness of Indian classical raga-based music therapy in managing insomnia by integrating the results of the prevailing clinical and experimental studies. The reviewed evidence indicates that the exposure to particular ragas may help to improve the effects of sleep, such as better sleep quality, less severity of insomnia, and finally less psychological stress. A number of studies also provided evidence that music interventions that are raga-based can induce physiological relaxation, as well as the regulation of the activity of the autonomic nervous system, which are essential in helping the onset of sleep and the maintenance of healthy sleep patterns.

Although these results are encouraging, the literature on the topic is still limited due to methodological inconsistencies, limited sample sizes, and inconsistent conditions of interventions. A variety of differences in the study design, raga types, time of interventions, and evaluation tools complicate the process of making conclusive findings on the effectiveness of the raga-based music therapy as a whole in the treatment of insomnia. However, the uniformity of the positive trends in the literature confirms the possibility of this traditional music system as an additional therapeutic system.

In general, it can be concluded that Indian classical raga-based music therapy is a potentially successful, non-invasive, and culturally relevant intervention in managing insomnia. The current study needs to be followed by future research based on the large-scale randomized clinical trials and standardized intervention programs to create more robust evidence and justify its inclusion in clinical practices related to sleep management.

References:

1. Baglioni, C., Battagliese, G., Feige, B., Spiegelhalder, K., Nissen, C., Voderholzer, U., ... & Riemann, D. (2011). Insomnia as a predictor of depression: a meta-analytic evaluation of longitudinal epidemiological studies. *Journal of affective disorders*, *135*(1-3), 10-19.
2. Deshmukh, A. D., Sarvaiya, A. A., Seethalakshmi, R., & Nayak, A. S. (2009). Effect of Indian classical music on quality of sleep in depressed patients: A randomized controlled trial. *Nordic Journal of Music Therapy*, *18*(1), 70-78.
3. Gitanjali, B. A. T. M. A. N. A. B. A. N. E. (1998). Effect of the Karnatic music raga" Neelambari" on sleep architecture. *Indian journal of physiology and pharmacology*, *42*, 119-122.
4. Jespersen, K. V., Koenig, J., Jennum, P., & Vuust, P. (2015). Music for insomnia in

adults. *Cochrane database of systematic reviews*, (8).
5. Krystal, A. D., Prather, A. A., & Ashbrook, L. H. (2019). The assessment and management of insomnia: an update. *World Psychiatry*, *18*(3), 337-352.
6. MacDonald, R. (2021). The social functions of music: Communication, wellbeing, art, ritual, identity and social networks (C-WARIS). In *Routledge international handbook of music psychology in education and the community* (pp. 5-20). Routledge.
7. Venkatarangam, S. (2021). Participants' experiences of a receptive music therapy intervention that incorporates raga: an interpretative phenomenological analysis. *The Arts in Psychotherapy*, *73*, 101762.
8. Pareek, S., & Shekhawat, D. (2022). A Pilot Study of Therapeutic Effects of Indian Classical Raga on Depression, Anxiety and Stress among Adults. *Indian Journal of Positive Psychology*, *13*(3), 212-215.
9. De Witte, M., Spruit, A., Van Hooren, S., Moonen, X., & Stams, G. J. (2020). Effects of music interventions on stress-related outcomes: a systematic review and two meta-analyses. *Health psychology review*, *14*(2), 294-324.
10. Chand, K., Chandra, S., & Dutt, V. (2024). Raga Bhairavi in virtual reality reduces stress-related psychophysiological markers. *Scientific Reports*, *14*(1), 24816.
11. Lund, H. N., Pedersen, I. N., Johnsen, S. P., Heymann-Szlachcinska, A. M., Tuszewska, M., Bizik, G., ... & Mainz, J. (2020). Music to improve sleep quality in adults with depression-related insomnia (MUSTAFI): study protocol for a randomized controlled trial. *Trials*, *21*(1), 305.
12. Chang, E. T., Lai, H. L., Chen, P. W., Hsieh, Y. M., & Lee, L. H. (2012). The effects of music on the sleep quality of adults with chronic insomnia using evidence from polysomnographic and self-reported analysis: a randomized control trial. *International journal of nursing studies*, *49*(8), 921-930.
13. Harmat, L., Takács, J., & Bódizs, R. (2008). Music improves sleep quality in students. *Journal of advanced nursing*, *62*(3), 327-335.
14. Lai, H. L., & Good, M. (2006). Music improves sleep quality in older adults. *Journal of advanced nursing*, *53*(1), 134-144.
15. Chan, M. F., Chan, E. A., Mok, E., & Kwan Tse, F. Y. (2009). Effect of music on depression levels and physiological responses in community-based older adults. *International journal of mental health nursing*, *18*(4), 285-294.
16. Nayak, A. P., Vishrutha, K. V., & Nayak, V. K. R. (2020). Effect of Indian classical music microtones on sleep quality and memory in young adults. *Biomedicine*, *40*(1), 76-82.
17. Mukherjee, R. (2021). Impact of music intervention (listening to Indian classical music) on mental wellbeing during COVID-19 pandemic. *Jurnal Litbang Edusaintech*, *2*(2), 63-78.
18. Krishnamurthy, T., & Rao, B. V. (2025). Indian classical Mohana raga (instrumental music) overcomes anxiety, depression and memory impairment in chronic unpredictable mild stress rat model–A behavioural study: MUSIC RESTORES COGNITIVE FUNCTIONS IN STRESS. *Indian Journal of Traditional Knowledge (IJTK)*, *24*(4), 319-328.
19. Banerjee, A., Sanyal, S., Roy, S., Sengupta, S., Biswas, S., Nag, S., ... & Ghosh, D. (2017). Neural (EEG) response during creation and appreciation: a novel study with hindustani raga music. *arXiv preprint arXiv:1704.05687*.
20. Sanyal, S., Banerjee, A., Guhathakurata, T., Sengupta, R., & Ghosh, D. (2016). A non linear approach towards automated emotion analysis in hindustani music. *arXiv preprint arXiv:1612.00172*.
21. Jespersen, K. V., Otto, M., Kringelbach, M., Van Someren, E., & Vuust, P. (2019). A randomized controlled trial of bedtime music for insomnia disorder. *Journal of sleep research*, *28*(4), e12817.
22. Thoma, M. V., La Marca, R., Brönnimann, R., Finkel, L., Ehlert, U., & Nater, U. M. (2013). The effect of music on the human stress response. *PloS one*, *8*(8), e70156.
23. Chanda, M. L., & Levitin, D. J. (2013). The neurochemistry of music. *Trends in cognitive sciences*, *17*(4), 179-193.
24. Koelsch, S. (2014). Brain correlates of music-evoked emotions. *Nature reviews neuroscience*, *15*(3), 170-180.
25. Trappe, H. J. (2009). Music and health--what kind of music is helpful for whom? What music not?. *Deutsche Medizinische Wochenschrift (1946)*, *134*(51-52), 2601-2606.

26. Loewy, J., Stewart, K., Dassler, A. M., Telsey, A., & Homel, P. (2013). The effects of music therapy on vital signs, feeding, and sleep in premature infants. *Pediatrics*, *131*(5), 902-918.
27. Johnson, J. E. (2003). The use of music to promote sleep in older women. *Journal of community health nursing*, *20*(1), 27-35.
28. Allen, K., & Blascovich, J. (1994). Effects of music on cardiovascular reactivity among surgeons. *Jama*, *272*(11), 882-884.
29. Nilsson, U. (2008). The anxiety-and pain-reducing effects of music interventions: a systematic review. *AORN journal*, *87*(4), 780-807.
30. Su, C. P., Lai, H. L., Chang, E. T., Yiin, L. M., Perng, S. J., & Chen, P. W. (2013). A randomized controlled trial of the effects of listening to non-commercial music on quality of nocturnal sleep and relaxation indices in patients in medical intensive care unit. *Journal of advanced nursing*, *69*(6), 1377-1389.