Review article

The effect of music intervention on depression in perinatal women: A systematic review

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ABSTRACT

Objective: Perinatal depression has become a global public health problem, which not only harms the health of mothers and their offspring, but also increases the socio-economic burden, so early intervention is urgent. Music intervention is a low-cost and safe intervention method. This study endeavored to systematically integrate and quantitatively evaluate the effectiveness of music intervention for perinatal depression.
Methods: PubMed, Embase, Web of Science and Cochrane Library were searched systematically. The search period was up to September 1, 2024. The included studies were summarized and analyzed.
Results: A total of 1375 articles were obtained through preliminary search, and 13 of them were finally included. The effect of music intervention on perinatal depression was better than that of the control group (SMD = −0.53, 95%CI (−0.81, −0.26), $p < 0.05$). Music intervention had no significant effect on alleviating anxiety (SMD = −0.47, 95%CI (−0.63, −0.31), $p > 0.05$). However, the heterogeneity of the included studies was significant.
Conclusions: This study indicated that music intervention had a significant effect on alleviating perinatal depression, but the effect on anxiety was not significant. However, the results were highly heterogeneous, and large-scale, multi-center, and long-term studies are needed in the future to confirm this.

1. Background

Perinatal Depression (PND) refers to a psychological disorder that occurs from the beginning of pregnancy to one year postpartum, including both prenatal and postpartum depression [1]. The main clinical manifestations are low mood, loss of interest, decreased attention and delayed thinking [2]. The overall global prevalence of PND was approximately 24.7 % [3]. Studies have shown that PND not only affects the physical and mental health of mothers and pregnancy outcomes, but also affects the neural development and

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cognitive function of offspring [4]. Furthermore, women with PND had a higher risk of suicidal behavior compared to ordinary perinatal women (HR = 3.15) [5]. In addition to the impact on women and their offspring, PND also brings a huge burden to society, studies have showed that the lifetime cost of perinatal depression can reach £75,728 per person, and the annual financial cost of perinatal depression in the UK was £6.6 billion [6]. Therefore, early intervention of PND is urgent.

At present, there are two main types of intervention: drug intervention and non-drug intervention. Research has shown that compared to not using antidepressants, the use of antidepressants in early pregnancy was associated with a slight increase in the risk of premature birth [7], women who come into contact with drugs before 16 weeks of pregnancy had a three-fold increased risk of developing preeclampsia [8]. Considering the potential side effects of antidepressants and their impact on breastfeeding, mothers are more likely to discontinue their use. Therefore, we need to shift our focus to non-pharmacological interventions. Registered Nurses' Association of Ontario (RNAO) guidelines recommended Cognitive Behavioral Therapy (CBT) and Interpersonal Psychotherapy (IPT) as first-line therapies for mild to moderate postpartum depression [9], but mental health professionals are needed to guide interventions, and mental health resources in low - and middle-income countries (LMICs) are inadequate to meet public demand. Therefore, choosing appropriate and effective intervention plans is of great significance for improving perinatal health care.

Music intervention is a simple and convenient intervention method. Music intervention mainly includes music therapy, music medicine, community music, music education and the daily use of music [10]. Music therapy emphasizes the practice of a licensed music therapist, and the patient is involved throughout the treatment process, working together to achieve specific therapeutic goals. Community music is an opportunity to participate in music within the local community and is led by community musicians. Music medicine generally refers to clinical doctors selecting music for patients in hospitals or undergoing special treatments. Music education focuses on developing traditional music skills. The daily use of music refers to people's active or passive use of music [11]. Although the implementation methods are different, the basic principle is similar. They all utilize the ability of music to change emotions.

Studies have explored the effectiveness of music intervention in alleviating prenatal or postnatal depression [12,13]. But we found that the differences in various factors that may lead to different effects of music intervention have not been specifically analyzed. This study explored music type, duration of music intervention, study country and intervention stages separately, hoping to provide reference for the development of music intervention plans in clinical practice.

2. Methods

2.1. Search strategy

This study was registered in the PROSPERO database, with the serial number CRD42024505821."perinatology/postpartumperiod/ peripartum/antenatal/antepartum/predelivery/prenatal/postnatal/perinatal/purperium/postpartum/material/pregnan*""depression/depressive disorder/blue/depress*""music/rhythm*/body/audio/tempo*" "Intervention/treatment" were English search terms, and the searched databases included PubMed, Web of Science, Cochrane Library and Embase. In addition, we also searched references from included studies, relevant reviews, or meta-analyses. The search period was nearly 20 years, and the search date ending on September 1, 2024.

2.2. Inclusion and exclusion criteria

2.2.1. Participant types
The women at the perinatal and postpartum period, aged ≥18 years old. The birth delivery mode was not limited.

2.2.2. Intervention types
Patients in the experimental group received music intervention on the basis of routine care, and the type of music was not restricted. Soft music, pop music, nature sounds, and even music that the patient preferred were acceptable. There was also no limit to the frequency and time of music.

2.2.3. Control group intervention
Patients in the control group received routine care, including health education and psychological care.

2.2.4. Outcome types
Depression was the primary outcome of the study, with secondary outcomes including anxiety, pain, sleep, satisfaction, etc.

2.2.5. Studies types
The study design was randomized controlled trial (RCT), which can improve the reliability of research results.

2.2.6. Exclusion criteria
(1) Literature types include proposal, draft, guideline interpretation, report and duplicate publications; (2) Unable to obtain full-text literature; (3) Non English articles.
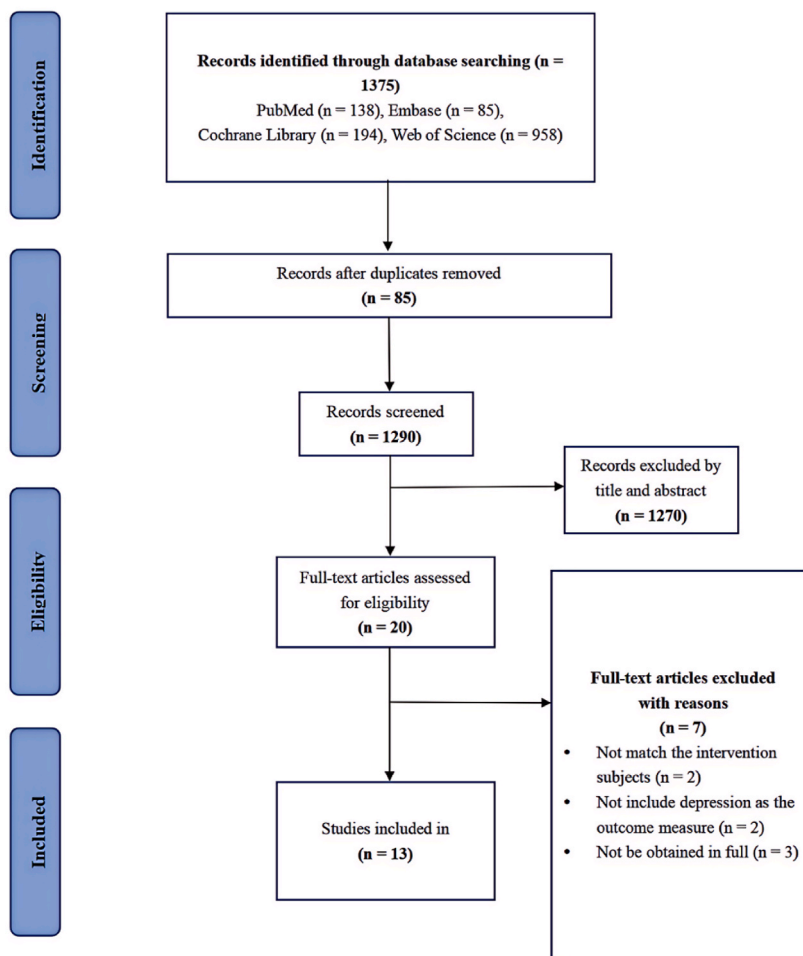
Fig. 1. Flowchart of the selection process.

2.3. Study selection and data extraction

We imported the retrieved literatures into EndNote 20 software to screen for duplicate literatures. Two trained researchers read the titles and abstracts based on the inclusion and exclusion criteria of the literature for initial screening, and then read the entire text for a second screening. When disagreements were encountered during the screening process, a third researcher made the final decision. All included data were independently extracted by two researchers, mainly including author, publication time, study design, country, intervention stage, music type, intervention personnel, duration of each intervention, intervention location, intervention frequency, intervention period, sample size and outcome indicators.

2.4. Literature quality evaluation

Two researchers conducted independent evaluations, and in case of discrepancies, a third researcher re-evaluated. Quality appraisal was performed using a risk of bias tool RCT 5.1.0 guided by the Cochrane Handbook for Systematic Reviews of Interventions for assessment, including randomization protocols, allocation concealment, blinding of investigators and participants, and outcome assessment, completeness of results, and selective reporting of study results and other bias. Each project was rated as "low risk", "high risk", or "unclear". If the original study fully meets the above criteria, the risk of bias is low and the quality grade is A, if it meets some of the criteria, the risk of bias is moderate and the quality grade is B, if it does not meet all of the above criteria, the risk of bias is high and the quality grade is C.

2.5. Data analysis

We utilized Stata17.0 to perform the meta-analysis. Standardized mean differences (SMDs) and 95 % confidence intervals (CI) were

Table 1

Basic characteristics of the included studies (n = 13).

Author (year)	Type of study; Country	Intervention stage	Music type	Intervention personnel	Intervention time	Intervention location	Intervention frequency	Intervention period	sample size (E/C)	Outcome measures
Dereddy et al., 2024 [14]	Rct; USA	Postnatal	Preferred	Music therapist	30 min	NICU	4 times a day	7 days	20/20	⑩
Küçükkaya et al., 2024 [15]	Rct; Turkey	Postnatal	Turkish music	Researcher	30 min	At home	2 times a day	36 h	41/41	①⑪
Perkins et al., 2023 [16]	Rct; UK	Postnatal	Preferred	Musically trained research assistants	60 min	At home	/	6 weeks	44/45	①④
Kobus et al., 2022 [17]	Rct; Germany	Postnatal	Soft music	Music therapist	10–50 min	NICU	twice per week	until discharge	40/40	⑤⑥
Gaden et al., 2022 [18]	Rct; Argentina, Colombia, Israel, Norway, and Poland	Postnatal	Preferred	Music therapist	30 min	NICU	3 times per week	27 sessions	105/108	①⑦
Palazzi et al., 2021 [19]	Rct; Brazil	Postnatal	Preferred	Music therapist	20–30 min	NICU	2 times per week	6 sessions	22/17	①②③
Wulff et al., 2021 [20]	Rct; Germany	Antenatal	Classical Pure music	Music therapist	10–15 min	At home	daily	until birth	64/49	①②⑧⑨
Wulff et al., 2021 [21]	Rct; Germany	Postnatal	Lullabies	Music therapist	45 min	At home	daily	2–3 months	59/61	①②⑧
Sanfilippo et al., 2020 [22]	Rct; Gambia	Antenatal	Traditional repertoire	Medical staff	1 h	Clinic	weekly	6 weeks	50/74	①
Kehl et al., 2020 [23]	Rct; Switzerland	Postnatal	Preferred	Music therapist	20 min	NICU	2–3 times per week	8 sessions	10/6	①②③
Nwebube et al., 2017 [24]	Rct; UK	Prenatal	Specially composed songs	By oneself	20 min	At home	daily	12 weeks	111/111	①②
Simavli et al., 2013 [25]	Rct; Turkey	Postnatal	Preferred	Researcher	2 h	Hospital	daily	8 days	80/81	①⑧
Chang et al., 2008 [26]	Rct; China	Prenatal	Preferred	Music faculty members	30 min	At home	daily	2 weeks	120/121	①②⑧

Note: ①Edinburgh Postnatal Depression Scale (EPDS); ②State-Trait Anxiety Inventory (STAI); ③Perceived Stress Scale (PSS); ④Social support and loneliness; ⑤Allgemeine Depressions Skala (ADS-L); ⑥German version of the Center for Epidemiologic Studies Depression Scale (CES-D); ⑦General Anxiety Disorder-7 (GAD-7); ⑧Visual analogue scale (VAS); ⑨Maternal Antenatal Attachment Scale (MAAS); ⑩ Depression, Anxiety and Stress Scale −21 (DASS-21); ⑪ Stein Blues Scale (SBS).

Table 2
Methodological quantity evaluation of randomized controlled trials (n = 13).

Author (year)	Randomization protocols	Allocation concealment	Blinding of investigators and participants	Outcome assessment	Completeness of results	Selective reporting of study results	Other bias	Quality grade
Dereddy et al., 2024 [14]	low	low	high	unclear	low	low	low	B
Küçükkaya et al., 2024 [15]	unclear	unclear	high	unclear	low	low	low	B
Perkins et al., 2023 [16]	low	unclear	unclear	unclear	unclear	low	low	B
Kobus et al., 2022 [17]	unclear	unclear	unclear	unclear	low	low	low	B
Gaden et al., 2022 [18]	low	low	high	low	low	low	low	B
Palazzi et al., 2021 [19]	high	unclear	high	unclear	low	low	low	B
Wulff et al., 2021 [20]	unclear	unclear	high	unclear	low	low	low	B
Wulff et al., 2021 [21]	unclear	high	high	unclear	unclear	low	low	B
Sanfilippo et al., 2020 [22]	low	low	high	unclear	low	high	low	B
Kehl et al., 2020 [23]	unclear	unclear	high	low	low	high	low	B
Nwebube et al., 2017 [24]	low	low	unclear	unclear	unclear	low	low	B
Simavli et al., 2013 [25]	low	low	low	low	low	low	low	A
Chang et al., 2008 [26]	low	unclear	unclear	unclear	unclear	low	low	B

used to synthesize data for continuous outcome variables. Heterogeneity test was performed using Cochran test. When the heterogeneity results showed $p < 0.1$ and $I^2 > 50$ %, indicating high heterogeneity, a random effects model was used. Subgroup analysis was performed to explore the source of the heterogeneity.

3. Literature screening and results

3.1. Literature screening

A total of 1375 articles were obtained through preliminary search, with 85 duplicate articles removed. After two researchers independently read the titles and abstracts, 20 articles were left to read the full text. Among them, 2 articles did not match the intervention subjects, 2 articles did not include depression as the outcome measure, and 3 articles could not be obtained in full. Finally, a total of 13 articles were included. Literature screening flowchart and results as shown in Fig. 1.

3.2. Basic characteristics of literature

Among the 13 RCTs included, 9 studies were conducted in high-income countries, 4 studies were conducted in LMICs, 4 studies were intervened before delivery, and 9 studies were intervened after delivery. As shown in Table 1.

3.3. Literature quality evaluation

A total of 13 studies were included. Seven studies have clearly demonstrated the methods for generating random sequences [14,16, 18,22,24–26], 5 studies implemented allocation method concealment [14,18,22,24,25], 1 study used blinding for researchers and subjects involved in intervention implementation [25], 3 studies provided blinding methods for outcome measurement [18,23,25], 9 studies described the dropout rate and reasons for dropout of samples, and all outcome measures data were basically complete [14,15, 17–20,22,23,25], 11 studies reported detailed primary and secondary outcome measures [14–21,24–26]. The baseline data of all studies were comparable and the outcome measures of the research subjects were evaluated in the same way. One article had a quality level of A, while the remaining 12 articles had a quality level of B. The detailed content is in Table 2.
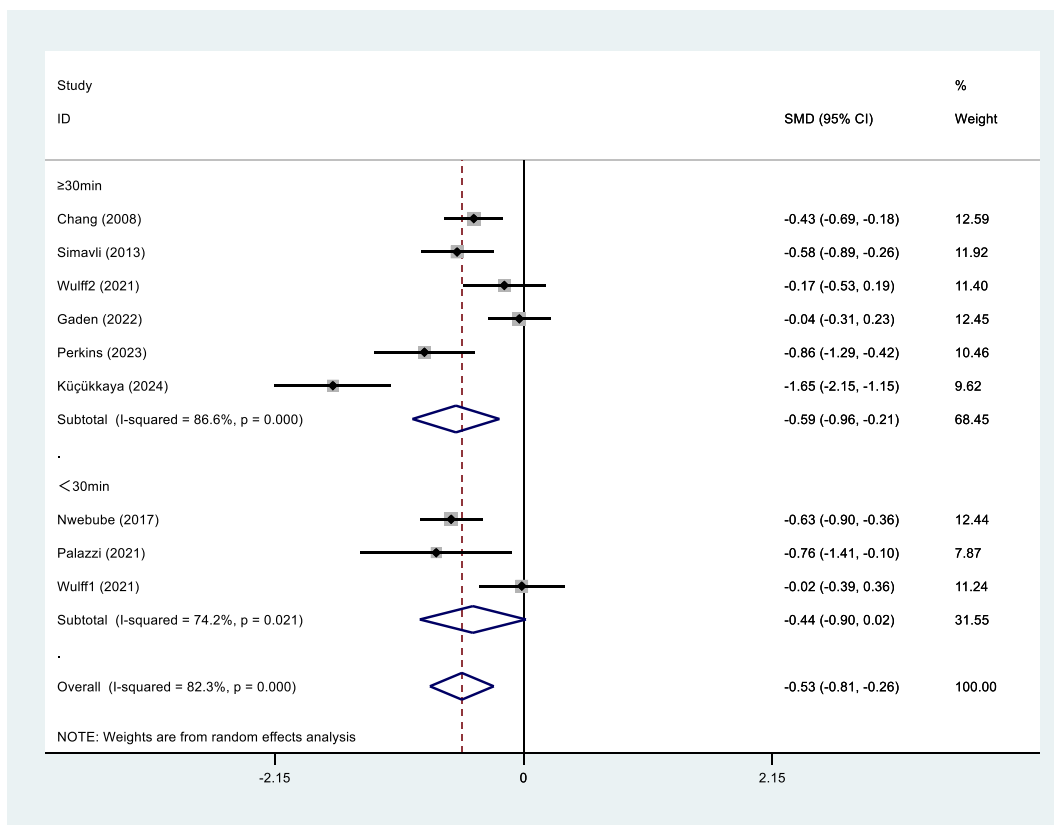
Fig. 2. Forest of the effect of music intervention on PND scores.

3.4. Changes in different indicators after intervention

3.4.1. Effect of music intervention on PND scores (EPDS was a measuring tool)

Nine studies were included, with a total of 1280 participants. Heterogeneity test $I^2 = 82.3$ %, therefore a random effects model was used. The results showed that the effect of music was significant, reflecting that the effect of music intervention on PND was better than that of the control group (SMD $= -0.53$, 95%CI $(-0.81, -0.26)$, $p < 0.05$). Subgroup analysis was divided into two groups based on the duration of each intervention, with each intervention duration <30min and ≥30min. The results showed that the effect of each intervention duration ≥30min (SMD $= -0.59$, 95%CI $(-0.96, -0.21)$, $p < 0.05$) was better than that of each intervention duration <30min (SMD $= -0.44$, 95%CI $(-0.90, -0.02)$, $p < 0.05$). As shown in Fig. 2.

Considering the effectiveness and heterogeneity of results of music intervention for PND, we further divided it into two subgroups based on the intervention stage: prenatal and postnatal. The results showed that music intervention after childbirth (SMD $= -0.59$, 95%CI $(-0.96, -0.21)$, $p < 0.05$) was more effective than before childbirth (SMD $= -0.44$, 95%CI $(-0.90, -0.02)$, $p < 0.05$), as shown in Fig. 3.

We divided them into two subgroups based on the type of intervention: preferred and recommended. The effect of recommended music intervention (SMD $= -0.59$, 95%CI $(-1.18, -0.01)$, $p < 0.05$) was better than that of preferred music (SMD $= -0.48$, 95%CI $(-0.77, -0.20)$, $p < 0.05$), as shown in Fig. 4.

We divided the study countries into two subgroups: high-income countries and LMICs, and the result showed that music intervention was more effective in alleviating PND in LMICs (SMD $= -0.85$, 95%CI $(-1.44, -0.25)$, $p < 0.05$) than in high-income countries (SMD $= -0.38$, 95%CI $(-0.67, -0.08)$, $p < 0.05$), as shown in Fig. 5.

3.4.2. Effect of music intervention on anxiety scores (GAD-7 was a screening tool)

Four studies were included, with a total of 622 participants. Heterogeneity tests showed that $I^2 = 38.5$ %, music intervention had no significant effect on alleviating anxiety (SMD $= -0.47$, 95%CI $(-0.63, -0.31)$, p > 0.05), as shown in Fig. 6.

4. Discussion

The above findings indicated that music intervention was effective in alleviating perinatal depression. The mechanism may be that music can distract attention, trigger activity in brain regions related to emotional experiences, and activate the release of endorphins,
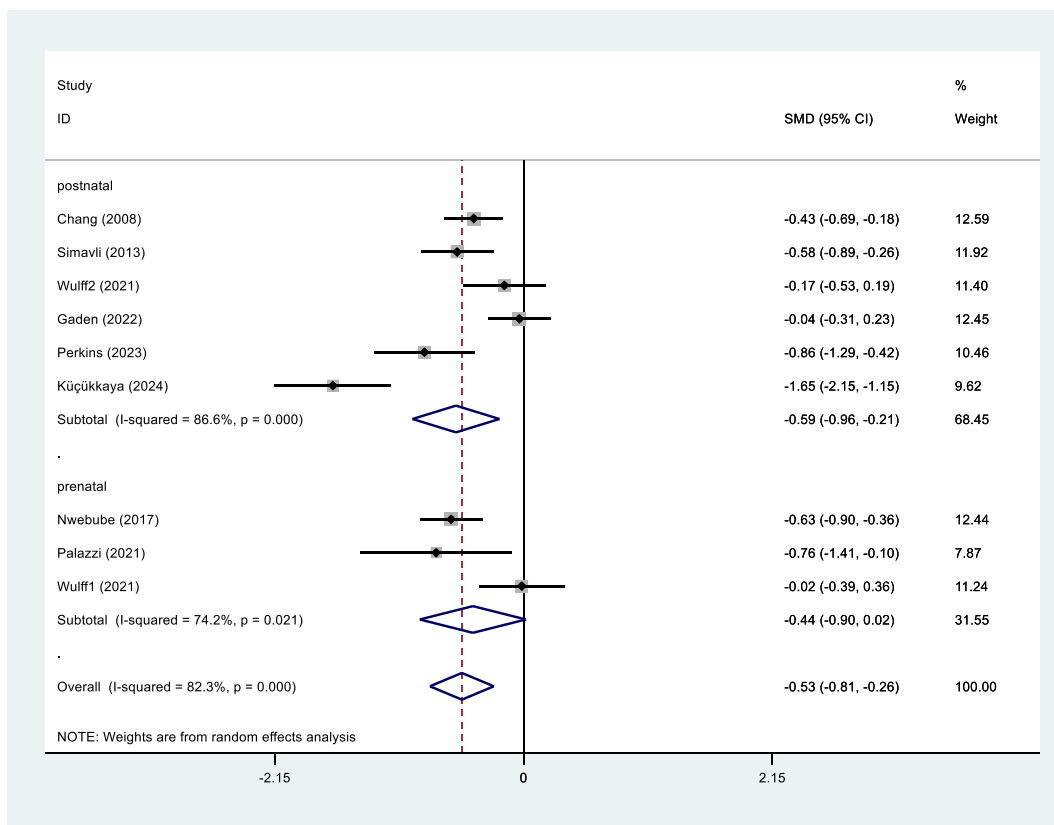
Fig. 3. Forest of the effect of music intervention on PND scores.

thereby regulating unpleasant feelings and emotions [27].

Subgroup analysis showed that music intervention had a more significant effect on postpartum depression. During the postpartum stage, music can strengthen the connection between mothers and newborns. Corey et al. found that using customized intervention courses and relaxation techniques in health education resulted in higher maternal satisfaction and a closer connection with the child [28]. During the period of receiving music intervention, the new mother had personal time and seemed to have mastered the ability to comfort the newborn. Our study found that each intervention duration ≥30min had better effect, which may be the reason for this. However, there is no similar study yet, and there is no unified standard for the duration of music intervention. Further studies are needed.

Music intervention was more effective in alleviating PND in LMICs. In the included studies, we found that there were only 4 studies on music intervention for women with PND in LMICs. In these countries, music intervention may be particularly useful as it is a low-cost intervention that aligns with the context of insufficient mental health resources in LMICs. A study conducted in India emphasized the impact of music-based interventions on maternal mental health. In these countries, music has become an integral part of healing culture and tradition [29]. Our results showed that the intervention was more effective when music was recommended by a music therapist or researcher. We speculate that the reason for this is that the music they chose fits in with local cultural traditions, and that perhaps the music has been shown to be effective in alleviating depression.

Among the included studies, one study mentioned online music intervention. Due to the influence of traditional culture, PND is difficult for most women to talk about, as they were concerned about being seen as an incompetent mother and were less likely to seek help and treatment offline [30]. Online intervention may break this situation. At present, more and more web-based interventions for depression have emerged. Spek et al. found that web-based interventions were superior to the control group [31]. Moreover. Danaher et al. also found that based on the online course intervention "Mom Mood Booster", the dropout rate of depressed women (13 %) was significantly lower than that of face-to-face psychotherapy (25 %–50 %), and patient satisfaction and depressive symptoms were significantly improved [32]. The benefits of implementing online intervention are not limited to that. Online intervention can achieve full monitoring function, urge PND women to clock in on time and promptly resolve any issues encountered during the intervention process, thereby improving the compliance of PND women. It can be seen from this that network-based music intervention can give expectations.

The results of this study showed that the evaluation of the effectiveness of music intervention mainly focused on psychological indicators such as depression, stress and anxiety, while there were relatively few evaluation indicators for the feasibility, compliance and economics of music intervention. In addition, when we analyzed and summarized existing studies, we found that some studies had
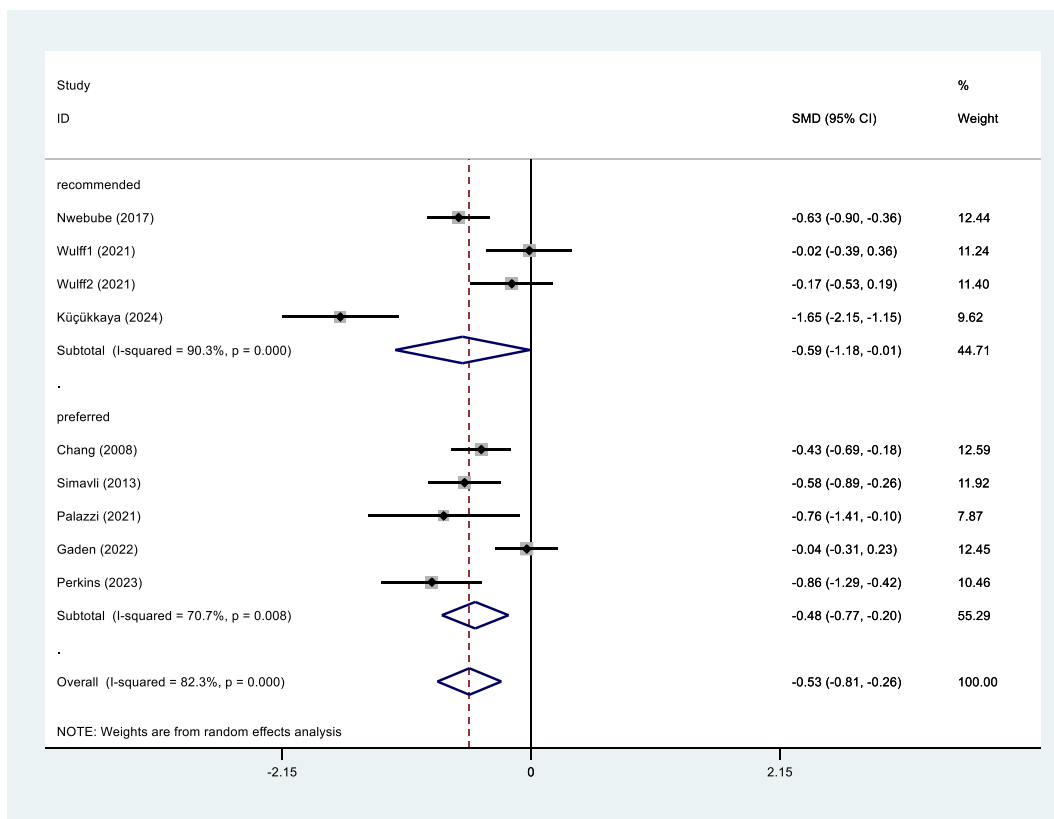
Fig. 4. Forest of the effect of music intervention on PND scores.

small sample sizes and may have produced invalid results, increasing the possibility of accidental results. Evaluation focused on short-term effects and lacked long-term effect tracking. More high-quality studies are needed in the future.

5. Limitations

This study has the following limitations: (1) only English literatures were included in this study; (2) lack of large sample RCTs; (3) failed to fully explain the source of heterogeneity, despite conducting subgroup analysis.

6. Conclusions

This study indicated that music intervention had a significant effect on alleviating perinatal depression, but the effect on anxiety was not significant. However, the research results were highly heterogeneous, and large-scale, multi-center, and long-term studies are needed in the future to confirm this.

Funding

Ethical approval

Not applicable.

Data

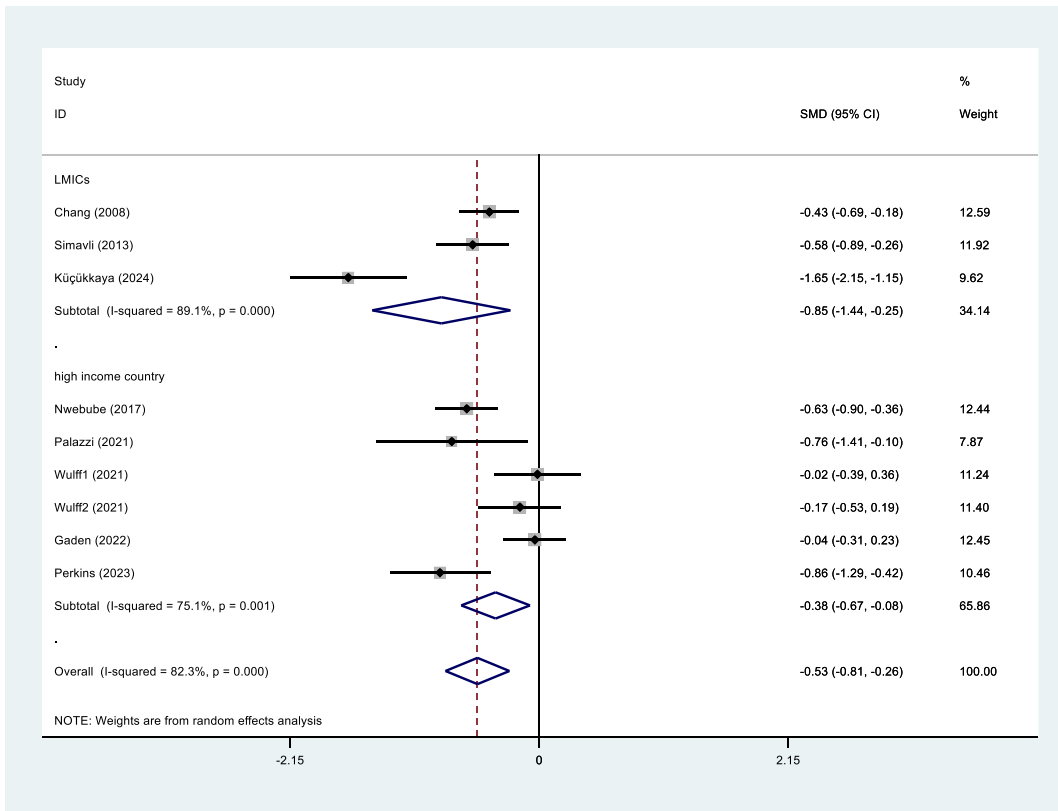All data can be found in tables or pictures in the review.

Fig. 5. Forest of the effect of music intervention on PND scores.
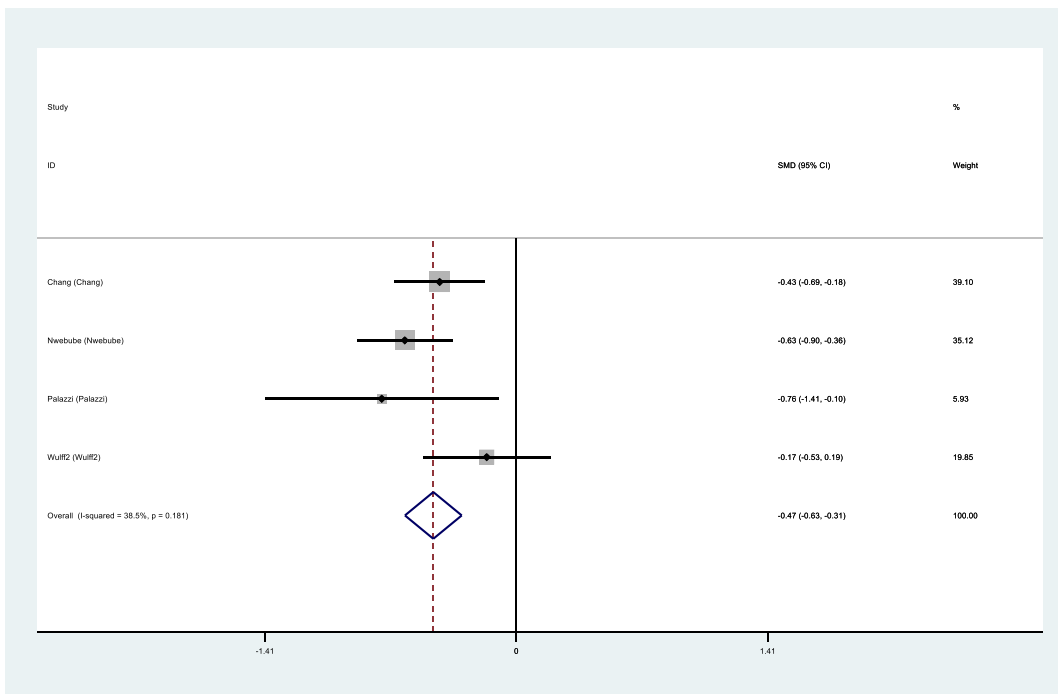

Fig. 6. Forest of the effect of music intervention on anxiety.

CRediT authorship contribution statement

Jingjing Han: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Shengnan Cong:** Formal analysis, Conceptualization. **Xiaoqing Sun:** Methodology. **Hongyan Xie:** Data curation, Conceptualization. **Shiqian Ni:** Data curation. **Yaxuan Wu:** Data curation. **Mengyao Wang:** Formal analysis. **Aixia Zhang:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e38476.

Appendix A. Search Strategy

Search Strategy (−2024/9)

PUBMED	
1#	((perinatology [MeSH Terms])OR(Postpartum Period[MeSH Terms]))OR ((antenatal[Title/Abstract])OR(antepartum[Title/Abstract])OR(prenatal[Title/Abstract])OR(postnatal[Title/Abstract])OR(perinatal[Title/Abstract])OR(peripartum[Title/Abstract])OR(puerperium[Title/Abstract])OR(puerperal [Title/Abstract])OR(postpartum[Title/Abstract]) OR (maternal[Title/Abstract]) (pregnan*[Title/Abstract]))
2#	((depression [MeSH Terms]) OR (Depressive Disorder [MeSH Terms])) OR ((blue [Title/Abstract]) OR (depress*[Title/Abstract]))
3#	Music [MeSH Terms] OR rhythm* OR melody OR audio OR tempo*
4#	((Intervention [MeSH Terms]) OR (Treatment [MeSH Terms]) OR therapy
5#	#1 AND #2 AND #3 AND #4
	Cochrane Library
1#	MeSH descriptor: [perinatology] explode all trees
2#	MeSH descriptor: [postpartum period] explode all trees
3#	MeSH descriptor: [Peripartum Period] explode all trees
4#	(antenatal or antepartum or prenatal or postnatal or perinatal or peripartum or puerperium or puerperal or postpartum or maternal): ti,ab,kw
5#	#1 OR #2 OR #3 OR #4
6#	MeSH descriptor: [depression] explode all trees
7#	MeSH descriptor: [depressive disorder] explode all trees
8#	(blue or depress*): ti,ab,kw
9#	#6 OR #7 OR #8
10#	MeSH descriptor: [music] explode all trees
11#	rhythm* OR melody OR audio OR tempo*
12#	#10 OR #11
13#	MeSH descriptor: [Early Intervention, Educational] explode all trees
14#	Treatment OR therapy
15#	#13OR #14
16#	#5 AND #9 AND #12 AND#15
	Embase
1#	'perinatology'/exp or 'puerperium'/exp or antenatal:ab, ti or antepartum:ab, ti or predelivery:ab, ti or prenatal:ab, ti or postnatal:ab, ti or perinatal:ab, ti or peripartum:ab, ti or puerperium:ab, ti or puerperal:ab, ti or postpartum:ab, ti or maternal:ab, ti or pregnan*:ab,ti
2#	'depression'/exp or 'depressive disorder': ab, ti or blue:ab, ti or depress*:ab,ti
3#	'music'/exp or ' rhythm*'/exp or melody or audio or tempo*
4#	'Intervention'/exp or 'treatment'/exp or therapy
5#	#1 AND #2 AND #3 AND #4
	Web of science
1#	TI= (perinatology or "postpartum period" or antenatal or antepartum or predelivery or prenatal or postnatal or perinatal or peripartum or puerperium or puerperal or postpartum or maternal or delivery or pregnan*)
2#	AB= (perinatology or "postpartum period" or antenatal or antepartum or predelivery or prenatal or postnatal or perinatal or peripartum or puerperium or puerperal or postpartum or maternal or delivery or pregnan*)
3#	1# OR 2#
4 #	TI= (depression or "depressive disorder" or blue or depress*)
5#	AB= (depression or "depressive disorder" or blue or depress*)
6#	4# OR 5#

(*continued*)

PUBMED	
7 #	TI= (music OR rhythm* OR melody OR audio OR tempo*)
8#	AB= (music OR rhythm* OR melody OR audio OR tempo*)
9#	7# OR 8#
10#	TI= (Intervention or Treatment or therapy)
11#	AB= (Intervention or Treatment or therapy)
12#	10# OR 11#
13#	#3 AND #6 AND #9AND #12

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