Effectiveness of nonpharmacological interventions for reducing postpartum fatigue: A systematic review and meta- analysis

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Research Article

Keywords: Fatigue, Postpartum, Nonpharmacological interventions, Systematic review, Meta-analysis

Posted Date: April 23rd, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-402893/v1>

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Abstract

Background: Postpartum fatigue is the most common issue among postnatal women and it could not only seriously affect the health of mothers but also bring about adverse impacts on their offspring. However, postpartum fatigue is an ongoing research issue but is seldom treated. This systematic review and meta-analysis aims to synthesize nonpharmacological evidence and evaluate the effectiveness of interventions for reducing postpartum fatigue among puerperae.

Methods: The Cochrane Library, PubMed, Embase, Web of Science, PsycINFO, CINAHL and ProQuest databases were searched for papers published from inception until February 2021. Grey literature was searched using OpenGrey. Randomized controlled trials (RCTs) or controlled clinical trials (CCTs) evaluating nonpharmacological interventions for postpartum fatigue reduction were eligible for inclusion. The methodological quality of the included studies was independently assessed by two reviewers using the Cochrane risk-of-bias tool and the risk of bias in nonrandomized studies of interventions. The meta-analysis was conducted using Review Manager 5.3.

Results: Seventeen published clinical trials matched the eligibility criteria for the systematic review, and thirteen studies involving 1686 participants were included in this meta-analysis. The results of the meta-analysis revealed that exercise (SMD = -1.74, 95% CI = -2.61 to -0.88), physical therapy (SMD = -0.50, 95% CI = -0.96 to -0.03) and drinking tea (MD = -3.12, 95% CI = -5.44 to -0.80) resulted in significant improvements in women's postpartum fatigue at postintervention. Drinking tea may have beneficial effects on depression (MD = -2.89, 95% CI = -4.30 to -1.49). Positive effects of psychoeducational interventions on postpartum fatigue or depression were not observed.

Conclusions: This review provides evidence that exercise, physical therapy and drinking tea are effective nonpharmacological interventions for relieving postpartum fatigue. Detailed instructions for postpartum exercise should be offered to puerperae. Physical therapy could be used in combination to enhance the intervention efficacy. Multiple daily cups of tea may be recommended. Psychoeducational interventions were ineffective for postpartum fatigue, but they could be integrated with the internet or smartphones to improve their effectiveness in the future. Fatigue-related nonpharmacological interventions of psychological outcomes still need to be studied.

Background

Postpartum fatigue is considered the most common issue that postnatal women confront when they transition to motherhood[1]. Postpartum fatigue is described as feelings of suffocation, exhaustion, and decreases in physical and mental capacity[2]. These symptoms may disturb approximately 64% of mothers in their postpartum stage[1]. It was reported that 38.8%, 27.1% and 11.4% of women perceived fatigue at 10 days, 1 month and 3 months after delivery, respectively, which indicates that the influence of postpartum fatigue on puerperae is general and persistent. Negative psychological symptoms (e.g., depression, anxiety and stress), sleep problems and less effective parenting behaviours are closely associated with the severity of postpartum fatigue[3–5]. Importantly, previous research demonstrated that postpartum fatigue could not only seriously affect the maternal health of mothers but also bring about adverse impacts on their offspring[6]. Experiences of fatigue could negatively affect breastmilk production, maternal-infant attachment and interactions[2, 5, 7], thereby delaying the development of babies[8].

Hence, it is significant to deliberately avert and relieve fatigue during the postpartum period via healthy and effective approaches. In fact, interventions for reducing postpartum fatigue have particular advantages. They are not only important to puerperae' physical relief but also have potential benefits on the improvement of maternal mental health. Cindy-Lee et al.[9] suggested that preventing postpartum depression could start from the perspective of fatigue management. Compared with recommended psychotherapy, fatigue management is less stigmatising and may be an acceptable first step for women to seek assistance and receive treatment for psychological issues[9].

However, postpartum fatigue is an ongoing research issue but is seldom treated. On the positive side, there is rapidly growing interest in this area. Although studies of nonpharmacological interventions conducted in puerperae with the aim of reducing fatigue are accumulating, different interventions may lead to varied effects[10–13]. Previous relevant systematic reviews and meta-analyses have clarified the positive relationship of postpartum fatigue and depression[3], the predictive factors of postpartum fatigue[1] and the effects of exercise on pregnancy and postpartum fatigue[14].

To the best of our knowledge, there is currently no in-depth systematic review and meta-analysis of nonpharmacological interventions specific for postpartum fatigue. Therefore, the aim of this study was to identify existing nonpharmacological interventions offered to postnatal women and to examine their effectiveness for relieving postpartum fatigue.

Methods

Protocol and registration

The protocol has been registered in the International Prospective Register of Systematic Reviews (PROSPERO); registration number CRD42021234869.

Study design

This systematic review and meta-analysis has been reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis statement (PRISMA). The PRISMA checklist can be seen in Additional file 1.

Search strategy

The focus of the review was to examine nonpharmacological interventions for fatigue reduction in postpartum women. Seven electronic databases, including the Cochrane Library, PubMed, Embase, Web of Science, PsycINFO, CINAHL and ProQuest, were searched for articles published from inception until February

2021 without language or time restrictions. An additional search of OpenGrey was conducted for grey literature. A combination of Medical Subject Heading, Emtree terms and free terms [e.g., (postnatal OR postpartum OR delivery OR childbirth OR birth OR parturition OR labour OR pregnancy) AND (fatigue OR mental fatigue OR lassitude OR exhaust*) AND (randomized controlled trial OR controlled clinical trial OR cohort OR clinical trial)] was used. The final search strategies applied are shown in Additional file 2. Moreover, a manual search of reference lists was performed to thoroughly identify relevant studies that were missed. Two authors (XXX and XXX) performed the search process independently.

Eligibility/exclusion criteria for selecting studies

The inclusion criteria of this review were as follows: (1) Study design: Clinical trials adopting randomized controlled trials (RCTs), quasi-experimental, before-and-after or prospective cohort study designs; (2) Participants: women aged 18 years or over who had a healthy pregnancy; and (3) Intervention: nonpharmacological interventions conducted during the women's postpartum period with the primary or secondary aim of decreasing fatigue symptoms. The intervention setting, frequency, timing and duration were not limited; (4) Comparison: usual care, placebo, waitlist or no interventions; and (5) Outcomes: the primary efficacy outcome was postpartum fatigue estimated as the rate or mean severity of fatigue. The second efficacy outcome was psychological variables, such as depression, anxiety or stress. The exclusion criteria were as follows: (1) duplicated publications (only the one with the most participants was included); (2) analyses of interventions based on postpartum fatigue in some special conditions, such as postpartum haemorrhage; and (3) studies without sufficient data to be extracted.

After removing duplicates, two authors (XXX and XXX) independently screened the studies according to the inclusion criteria in 2 steps: 1) title and abstract screening and 2) full-text screening. A third author (XX) was consulted to reach a consensus when there was any uncertainty about the inclusion of an article.

Data extraction

A standardized data extraction sheet was used to extract important information from the included studies. The extracted data included first author, publication year, country, study design, population, sample size (trial/control), intervention details (e.g., type, frequency and duration), control, evaluation time points, assessment tools and outcomes. Two authors (XXX and XXX) independently extracted the data, and any inconsistencies were resolved by a third author (XX).

Risk of bias summary

For RCTs, the Cochrane risk-of-bias tool was used for the quality assessment[15]. Studies were assessed based on seven criteria (random sequence generation, allocation concealment, blinding of participants and researchers, blinding of outcome assessor, incomplete outcomes data, selective reporting and other bias). Bias was evaluated as a judgement (high or low or unclear), and then each included study was rated as having a high, moderate or low risk of bias. The Risk of Bias in Nonrandomized Studies of Interventions was used to assess the risk of bias of non-RCTs[16]. Seven domains are evaluated in this tool (confounding, selection of participants into the study, classification of intervention, deviation from the intended interventions, missing data, measurements of outcomes and selection of the reported results). Two authors (XXX and XXX) assessed the risk of bias and evidence quality separately. Disagreements were discussed with a third researcher (XX) to reach a consistent conclusion.

Data analysis

We performed a meta-analysis utilizing Review Manager 5.3. For continuous outcomes, we calculated mean differences (MDs) and 95% confidence intervals (CIs) if the outcomes were measured using the same tool. We used standardized mean differences (SMDs) and 95% CIs to combine studies when the same outcome was measured by adopting different tools[17]. For the SMD, ≤ 0.20 , $= 0.50$, and ≥ 0.80 are designated as small, moderate and large effect sizes, respectively[18]. The heterogeneity among the analysed trials was examined by standard chi-square and I-square statistics. If the P value was > 0.1 or $I^2 < 50\%$, it indicated that there was no observed heterogeneity, and the researchers employed a fixed-effects model to combine the study results. If not, a random-effects model analysis was used[19].

Results

The identified citations were imported into EndNote software and screened for duplicates. The initial search of 7 databases revealed 2955 references. A search of reference lists and OpenGrey revealed 3 other relevant studies. After removing 879 duplicates, the titles and abstracts of the remaining 2079 articles were screened, which excluded 2042 articles and left 37 full-text articles that were reviewed for eligibility. Twenty studies were excluded for being abstracts and protocols ($n = 2$), interventions were not conducted in the postpartum period ($n = 6$), could not find the full text ($n = 1$), studies published in another language ($n = 2$), studies without fatigue outcomes ($n = 8$) and studies not involving clinical interventions ($n = 1$). Ultimately, 17 studies were included in this systematic review, and 13 studies met the criteria for meta-analysis. A PRISMA flow diagram illustrating the detailed study selection process is shown in Fig. 1.

Study characteristics

The study characteristics are summarized in Table 1. Studies were published between 2003 ~ 2020. The 17 included articles were conducted in different countries: China ($n = 5$), Iran ($n = 4$), the USA ($n = 2$), Canada ($n = 2$), Turkey ($n = 2$), Australia ($n = 1$) and the UK ($n = 1$). A total of 2142 participants were included in this systematic review. The sample size ranged from 27 to 356 participants in each trial. Eleven of the 17 included studies employed a randomized controlled trial design.

Four types of interventions were undertaken: exercise [12, 20–23] ($n = 5$), psychoeducational intervention[13, 24–29] ($n = 7$), physical therapy[10, 11, 30] ($n = 3$) and drinking tea [31, 32] ($n = 2$). The intervention duration ranged from 1 day to 3 months. All included studies described the baseline assessments, with the scores for the intervention and control groups comparable at baseline. Additionally, the studies reported assessment scores immediately after the intervention and follow-up assessment scores at 1 month postintervention[31, 32], 6 weeks[24, 25, 28] and 9 weeks postintervention[24], 2 months postintervention[20], 3 months postintervention[21, 23, 25, 28] and 6 months[23] postintervention. These trials adopted the MFI-20, MFSC, PFS, VAS-F, FAS and FSC to evaluate the

level of postpartum fatigue; the EDPS, DASS-21, CES-D, VAS for distress; and the PANAS and PSS were used to assess psychological variables such as depression, anxiety and stress.

Risk of bias of the evidence

The quality of the study designs was low to moderate overall. Several methodological limitations were observed in the critical appraisal. Quality assessments of the 11 included studies using an RCT design, with a risk of bias graph and risk of bias summary, are described in Fig. 2 and Fig. 3. All of the studies reported using randomization; however, two articles did not provide detailed information about the randomization method. Six studies reported sufficient details about allocation concealment. Blinding of the participants and researchers who delivered the interventions was not feasible because the interventions were easy to identify. Therefore, all of the studies are at a high risk of performance bias. Regarding detection bias, only four studies provided sufficient explanations. Except for one study, all RCT studies gave clear information about the incomplete outcome data. No reporting bias was found in the included RCTs.

The results of the quality appraisal of the six nonrandomized studies are displayed in Table 2. Bias due to confounding factors, selection of participants into the study and classification of interventions were low for all included nonrandomized studies. Three articles were at moderate risk of bias due to deviations from the intended intervention. All of the studies were reasonably reported and addressed missing data. In regard to bias in the measurement of outcomes, considering that the interventions were not blinded to the participants, all studies were judged as at moderate risk of bias. Bias in selection of the reported results was not observed.

Table 1
Study characteristics (n = 17)

First author (publication year)	Country	Study design	Population	Sample size (intervention/control)	Intervention trial	Frequency	Duration	Control	Evalu point
Exercise (n = 5)									
Ashrafinia[20] (2015)	Iran	RCT	Primiparous women, EPDS10	80 (40/40)	Pilates home exercises	5 times a week (30 min/session)	8 weeks	Routine postpartum care	Basel week: postp
Dritsa[21] (2008)	Canada	RCT	Women in the postpartum (4–38 weeks), EPDS $\geq$ 10	88 (46/42)	Aerobic exercise, stretching and strength exercises	60–120 min/week, 4 times	12 weeks	Through questionnaire assessing exercise participation once a month	Basel treatr mont postti
Ko[22] (2008)	China	A control group pre-/post- program design	Postpartum women who were “doing-the- month”	61 (31/30)	A low-intensity exercise program	6 sessions	3 weeks	Usual care	Before the pr
Lee[23] (2016)	UK	RCT	Postnatal women who had given birth between 6 weeks and one year previously	65 (33/32)	Physical activity consultations and a moderate- intensity walking programme	30–55 min/time, one session each week	10 weeks	Received a leaflet with information on physical activity	Basel mont mont up.
Yang[12] (2019)	China	RCT	Postnatal women who had vaginal delivery, EPDS $\leq$ 10	140 (70/70)	Moderate- intensity aerobic exercise	At least 3 times a week (15 min per section)	3 months	Usual postpartum care	Basel week: week: postti
Psychoeducational intervention (n = 7)									
Doering[24] (2018)	USA	Quasi- experimental	Postpartum women who had a healthy singleton newborn	27 (15/12)	Helping U Get Sleep	A home visit and 4 phone calls	4 weeks	Health education related to sleep for attention control	Basel postp week: 9
Gholami[26] (2017)	Iran	A control group pre-/post- program design	Women who had given birth	120(40/40/40)	Educational behavioural interventions (face-to-face or e-learning)	3 times	50 days	Usual postpartum care	Before the in
Giallo[25] (2014)	Australia	RCT	Mothers who had a child younger than the age of 6 months	202 (63/67/72)	Intervention group 1: professionally led support; Intervention group 2: self- directed written	A workbook, home visit, and three telephone support calls; reading the workbook	4 weeks	Usual care	Basel 12 we the ba
Milani[27] (2017)	Iran	Clinical trial	Healthy postpartum mothers, EDPS < 10	276 (92/184)	A comprehensive postpartum home care program	2 home visits after childbirth	60 days	Usual care	Prete: postti
Ozcan[13] (2020)	Turkey	RCT	Primiparous women	117 (58/59)	Levin's conservation model	8 sessions, each session lasted 60– 120 min.	12 weeks	Standard nursing care	Prete: postti

Notes: RCT: randomized clinical trial; MFI-20: Multidimensional Fatigue Inventory; PFS: Postpartum Fatigue Scale; VAS-F: visual analogue scale for fatigue; F: Modified Fatigue Symptoms Checklist; FSC: Fatigue Symptom Checklist; EDPS: Edinburgh Postnatal Depression Scale; DASS-21: Depression, Anxiety and Stress of the Center for Epidemiologic Studies Depression Scale; PANAS: Positive and Negative Affect Schedule; PSS: Perceived Stress Scale; AGWB1: Adapted Gene

First author (publication year)	Country	Study design	Population	Sample size (intervention/control)	Intervention trial	Frequency	Duration	Control	Evalu point:
Stremmler[28] (2013)	Canada	RCT	Primiparous women	246 (123/123)	Behavioural- educational sleep intervention	A 45–60 minute meeting, a 20 page booklet, and 3 phone contacts.	4 weeks	Usual care	Basel 12 we
Troy[29] (2003)	USA	Quasi- experimental	Healthy primiparous postpartum mothers	68 (32/36)	The Tiredness Management Guide as a self-care intervention	Women in the intervention group were asked to use the TMG whenever they felt tired	5 weeks	Usual postpartum care	Fatigu asses times befor bed a on ris Tuesd eveni Frida
Physical therapy (n = 3)									
Funda[10] (2020)	Turkey	RCT	Primiparous and had a vaginal delivery at the 37th to 40th weeks of gestation	80 (40/40)	Mother-infant skin-to-skin contact	1 time	30 minutes	Usual postpartum care	Befor the in
Hsieh[30] (2017)	China	Quasi- experimental	Healthy postpartum women	356 (94/264)	Take warm showers	1 time	20 minutes	Routine postpartum care	The fi postp and tl postp
Vaziri[11] (2017)	Iran	RCT	Primiparous women with normal vaginal delivery	56 (29/27)	Breathe lavender oil aroma	3 times, 10– 15 minutes each time	1 day	Sesame oil used as placebo	Basel the fir interv the to morn asses
Drinking tea (n = 2)									
Chang[32] (2015)	China	RCT	Postnatal women in their sixth postpartum week with poor sleep quality (PSQS score $\geq$ 16)	80 (40/40)	Drink one cup of chamomile tea	Every day	2 weeks	No intervention, regular postpartum care	Basel 2 and post interv
Chen[31] (2015)	China	RCT	Postnatal women with poor sleep quality (PSQS score $\geq$ 16)	80 (40/40)	Drink one cup of Lavender tea	Every day	2 weeks	Regular postpartum care	Basel week and 4 postt
Notes: RCT: randomized clinical trial; MFI-20: Multidimensional Fatigue Inventory; PFS: Postpartum Fatigue Scale; VAS-F: visual analogue scale for fatigue; F: Modified Fatigue Symptoms Checklist; FSC: Fatigue Symptom Checklist; EDPS: Edinburgh Postnatal Depression Scale; DASS-21: Depression, Anxiety and Str of the Center for Epidemiologic Studies Depression Scale; PANAS: Positive and Negative Affect Schedule; PSS: Perceived Stress Scale; AGWBI: Adapted Gene									

Table 2
Results of the quality appraisal of nonrandomized studies (n = 6)

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5	Domain 6	Domain 7	Judgement
Doering (2018)	Low	Low	Low	Low	Low	Moderate	Low	Moderate
Gholami (2017)	Low	Low	Low	Low	Low	Moderate	Low	Moderate
Hsieh (2017)	Low	Low	Low	Low	Low	Moderate	Low	Moderate
Ko (2008)	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate
Milani (2017)	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate
Troy (2003)	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate
Notes: Domain 1: Confounding; Domain 2: Selection of participants into the study; Domain 3: Classification of interventions; Domain 4: Deviations from intended interventions; Domain 5: Missing data; Domain 6: Measurement of outcomes; Domain 7: Selection of the reported results.								

Meta-analysis results

For the purposes of meta-analysis, postpartum interventions were grouped into four broad categories: exercise, psychoeducational interventions, physical therapy and drinking tea. Only one trial[27] reported the postpartum fatigue rate. Three trials[21, 23, 24] without sufficient original data for meta-analysis were thus not included. Ultimately, thirteen studies that reported the mean fatigue scores and standard deviations were included in the meta-analysis. For the secondary outcomes, since more than two studies reported depression, a statistical combination was performed regarding this psychological outcome.

Effectiveness of exercise

Figure 4 shows the effect sizes of the exercise intervention in terms of fatigue and depression. For the primary outcome, three trials showed a postassessment of fatigue. The heterogeneity was $I^2 = 95\%$ ($P < 0.0001$), so a random-effects model was applied. The pooled SMD was -1.74 (95% CI=-2.61 to -0.88, $Z = 3.94$, $P < 0.0001$), demonstrating that the exercise intervention had a better effect on decreasing fatigue symptoms. For the secondary outcome, depression data were presented in two trials. No significant effects on reducing depression were indicated. Significant heterogeneity was not detected ($I^2 = 46\%$, $P = 0.17$), so a fixed-effect model was used. The pooled SMD was -0.05 (95% CI=-0.33 to 0.24, $Z = 0.31$, $P = 0.75$).

Effectiveness of physical therapy

Three trials showed the effectiveness of physical therapy on posttreatment fatigue severity (Fig. 6). Significant improvements were observed in the participants who received physical therapy in comparison with the participants in the control groups. There was substantial evidence of high heterogeneity ($I^2 = 74\%$, $P = 0.02$), so a random-effect model was applied. The pooled SMD was -0.50 (95% CI=-0.96 to -0.03, $Z = 2.09$, $P = 0.04$).

Effectiveness of drinking tea

The effectiveness of drinking tea on fatigue and depression at postintervention and at the 2-week follow-up were presented in two trials (Fig. 7). At postintervention, significant differences were noted between the intervention and control groups in regard to fatigue and depression. No significant heterogeneity was found in terms of fatigue and depression ($I^2 = 0\%$, $P = 0.44$; $I^2 = 0\%$, $P = 0.74$). Therefore, a fixed-effects model was used. The pooled MD was -3.12 (95% CI=-5.44 to -0.80, $Z = 2.64$, $P = 0.008$) and -2.89 (95% CI=-4.30 to -1.49, $Z = 4.04$, $P < 0.0001$).

At the 2-week follow-up, the results suggested that there were no significant differences between the intervention and control groups in regard to fatigue. There was no evidence of significant heterogeneity ($I^2 = 0\%$, $P = 0.59$). The pooled MD was -1.38 (95% CI=-3.58 to 0.81, $Z = 1.24$, $P = 0.22$). The results showed that tea consumption had significant effects on depression at the 2-week follow-up. We used a fixed-effects model because the heterogeneity was $I^2 = 0\%$ ($P = 0.77$). The pooled MD was -2.05 (95% CI=-3.47 to -0.62, $Z = 2.82$, $P = 0.005$).

Discussion

Main findings

This systematic review identified a total of seventeen published clinical trials examining nonpharmacological interventions (including exercise, psychoeducational interventions, physical therapy and drinking tea) on postpartum fatigue in postnatal women. Thirteen studies involving 1686 participants were included in the meta-analysis to examine the respective effectiveness of each type of intervention.

The findings of the meta-analysis suggest that exercise intervention significantly reduces symptoms of postpartum fatigue (SMD= -1.74, 95% CI=-2.61 to -0.88, $Z = 3.94$, $P < 0.0001$). This is consistent with the findings of previous studies[33, 34], which clarified the necessities and benefits of physical exercise for the overall health of postpartum women. A meta-analysis[35] indicated that postpartum exercise was beneficial for decreasing postpartum fatigue (SMD = 0.36). The benefits of exercise on fatigue are worth affirming. However, postpartum women are still at high risk for physical inactivity and rarely understand how to engage in postpartum exercise[33]. The American College of Obstetricians and Gynaecologists (ACOG) suggested that physical activity, including performing muscle-toning exercises, could be restarted 6 weeks after childbirth if the delivery was uncomplicated[36]. Daily 20 ~ 30 min of regular moderate-to-intense exercise is recommended[37]. A previous study reported that supervised postpartum exercise lasting more than eight weeks is suggested for reducing postpartum fatigue[14]. Therefore, clinical staff should give sufficient explanations and evidence-based instructions for postnatal exercises to help reduce women's postpartum fatigue and facilitate their postpartum rehabilitation.

For depression, the results showed that there were no significant differences between the two groups (SMD=-0.05, 95% CI=-0.33 to 0.24, $Z = 0.31$, $P = 0.75$). This is inconsistent with the findings of a previous meta-analysis[38], which reported that exercise reduced symptoms of depression (SMD=-0.81, 95% CI=-1.53 to -0.10) of mothers who had been diagnosed with depression. The insignificant results may be explained by the fact that the two studies[12, 22] in our review did not include participants with obvious depressed symptoms at baseline. Therefore, a significant reduction in depression was difficult to observe after the exercise intervention. It is worth noting that in Yang et al.[12]'s study, women reported feelings of mood relaxation and pressure relief after the intervention, which indicated that exercise may have potential efficacy for women's mental health. More research conducting exercise interventions among puerperae who have severe symptoms of psychological problems is needed to confirm the true effect of exercise on mothers' psychological well-being.

Five studies performing psychoeducational interventions showed no obvious differences in postpartum fatigue and depression between the two groups at either the postintervention or 8-week follow-up. Although psychoeducational interventions usually involve various aspects associated with postnatal health, including fatigue, sleep, infection, nutrition, breastfeeding and so on, this type of intervention was mostly delivered via home visits, leaflet/booklets and home calls. It is difficult to guarantee the good compliance of participants due to a lack of sufficient supervision and guidance. Therefore, it may be difficult to perform psychoeducational interventions effectively. With the development of rapid electronic technology, people's requests for health services have also facilitated instant communication and promoted efficiency in the transmission of information[39]. A previous study reported that web-based interventions had better effects on improving postnatal depression than home-based postnatal psychoeducational interventions[40] and suggested that web-based interventions should be introduced to mothers for better postnatal care. Hence, psychoeducational interventions could be combined with internet technology[41] or smartphones[42] in the future to improve the participation of women, observe the compliance of the participants and better manage the intervention implementation.

The findings from our meta-analysis of three studies[10, 11, 30] suggested that physical therapy was an effective treatment in relieving postpartum fatigue (SMD= -0.50, 95% CI=-0.96 to -0.03, $Z = 2.09$, $P = 0.04$). The intervention frequency of the included physical therapies ranged from 1 ~ 3 sessions. Each session lasted 10 ~ 30 minutes. These interventions were completed in 1 day. Physical therapies have the advantages of a short intervention time and good controllability. Warm showers, as a comfort measure, are closely associated with increased relaxation and tension reduction[43]. It is a safe and effective measure for healthy, labouring women who are experiencing physical and psychological issues[43]. The benefits of lavender oil on postpartum fatigue were reported in another RCT conducted among pregnant women[44]. Participants in either the lavender and footbath or lavender alone group showed that fatigue was improved significantly at 6 weeks postpartum. Although the efficacy of mother-infant skin-to-skin on fatigue was not observed in Funda et al.'s study, a recently published meta-analysis demonstrated that mother-infant skin-to-skin was a cost-effective, simple and feasible approach for postpartum depression[45]. Considering that physical therapies are relatively safe and effective, physical therapies such as footbaths[44], reflexology[46], warm showers[30] and lavender oil[11], which show effects on fatigue reduction and mental health improvement, could be used in combination to enhance the intervention efficacy. Among the three included studies, only Vaziri et al.'s study examined the efficacy of lavender oil aroma for psychological outcomes, including distress and mood, and positive effects were observed. More research is needed to explore its effectiveness for mental health.

In terms of drinking tea, the results showed that there were significant differences in postpartum fatigue between the two groups at postintervention (MD= -3.12, 95% CI=-5.44 to -0.80, $Z = 2.64$, $P = 0.008$), but no significant differences were found at the 2-week follow-up. The positive effects of drinking tea on relieving depression were obvious at the postintervention and 2-week follow-up. Postnatal women were required to smell (appreciate) the aroma before drinking the tea. Aromatherapy has been used for pain and anxiety relief, relaxation, and creating a pleasant feeling in mothers[47-49], which could help to relieve fatigue and depressive emotions. Women in the intervention group reported the benefits of drinking chamomile tea to be facilitating emotional stability and relaxation and having an aromatic fragrance, which could calm restlessness, facilitate the postnatal paternity relationship, and alleviate postpartum fatigue[50]. However, the positive effects did not last long after the intervention. Thus, multiple daily consumption of tea may be recommended to assess its lasting effect in consideration of its convenience.

Strengths and limitations

To the best of our knowledge, this is the first systematic review and meta-analysis on nonpharmacological interventions for reducing postpartum fatigue. This review was rigorous and based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis statements as well as a prospective registered protocol. Another strength was that randomized controlled trials and controlled clinical trials were included in this review, which provides good standards for evidence-based research.

There were some limitations of this systematic review. First, a limitation of the review was that non-English electronic databases were not searched, which may cause language bias[51]. Second, the number of included studies for each type of intervention was small. The heterogeneity in the statistical combinations of exercise, psychoeducational intervention and physical therapy was significant. These factors may have an impact on the reliability of the pooled results. Third, a limitation lies in the risk of bias within the included studies. The potential biases may have influenced the reported effect estimates; therefore, caution is required when interpreting the findings of our study.

Conclusions

The results from this systematic review and meta-analysis provide evidence that nonpharmacological interventions, including exercise, physical therapy and drinking tea, are effective in reducing postpartum fatigue. Detailed and evidence-based instructions involving exercise frequency and duration should be offered to puerperae. Considering that physical therapies are relatively safe, they could be used in combination to enhance the intervention efficacy. Multiple daily cups of tea may be recommended to assess its lasting effect. The effects of psychoeducation were not noted, and future research could integrate psychoeducation with internet technology or smartphones to improve the compliance of the participants. The effectiveness of fatigue-related nonpharmacological interventions on psychological outcomes still needs to be further investigated due to the limited number of studies.

Abbreviations

RCT: Randomized controlled trial; CCT: Controlled clinical trial; PROSPERO: International prospective register of systematic reviews; PRISMA: Preferred reporting items for systematic reviews and meta-analyses; MFI-20: Multidimensional Fatigue Inventory; PFS: Postpartum Fatigue Scale; VAS-F: visual analogue scale for fatigue; FAS: Fatigue Assessment Scale; MFSC: Modified Fatigue Symptoms Checklist; FSC: Fatigue Symptom Checklist; EDPS: Edinburgh Postnatal Depression Scale; DASS-21: Depression, Anxiety and Stress Scale-21; CES-D Scale: Chinese version of the Center for Epidemiologic Studies Depression Scale; PANAS: Positive and Negative Affect Schedule; PSS: Perceived Stress Scale; AGWBI: Adapted General Well-Being Index; CI: Confidence interval; MD: Mean difference; SMD: standardized mean difference.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Acknowledgements

Not applicable.

Authors' contributions

This systematic review was conceived and drafted by JLQ under the supervision of XYY; JLQ and SWS independently searched electronic databases and screened titles and abstracts. JLQ and SWS were responsible for reviewing the included studies. Disagreements were discussed with a third researcher (LL) to reach a consistent conclusion. All authors contributed to the draft revision.

Funding

This work was supported by Medical and Health Research Project of Zhejiang Province (grant number 2020KY173)

Competing interests

None declared.

Availability of data and materials

Data will be available from the corresponding author upon reasonable request

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Figures

Figure 1

PRISMA flow diagram

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Ashrafinia 2015	+	?	+	?	+	+	?
Chang 2015	?	+	+	+	+	+	?
Chen 2015	+	+	+	+	+	+	+
Dritsa 2008	+	+	+	+	+	+	+
Funda 2020	+	+	+	?	+	+	+
Giallo 2014	+	+	+	?	+	+	?
Lee 2016	?	?	+	+	+	+	?
Ozcan 2020	+	+	+	?	+	+	+
Stremier 2013	+	+	+	+	+	+	+
Vaziri 2017	+	?	+	+	+	+	?
Yang 2019	+	+	+	?	+	+	+

Figure 2

Risk of bias for individual RCTs

Figure 3

Risk of bias summaries for the included RCTs

A: Fatigue scores at postintervention

B: Depression scores at postintervention

Figure 4

Forest plots for the effect of exercise on fatigue (A) and depression (B) postintervention. Notes: Ashrafinia et al.'s study assessed general fatigue (a), physical fatigue (b), reduced activity (c), reduced motivation (d), and mental fatigue (e).

A: Fatigue scores at postintervention

B: Depression scores at postintervention

C: Fatigue scores at 8-week follow-up

D: Depression scores at 8-week follow-up

Figure 5

Forest plots for the effect of psychoeducational interventions on fatigue at postintervention (A), depression at postintervention (B), fatigue scores at the 8-week follow-up (C), and depression scores at the 8-week follow-up (D). Notes: Gholami et al.'s study included two intervention groups (i: e-learning and ii: face to face), which had assessment scores. Giallo et al.'s study included two intervention groups (i: professionally led telephone support and ii: self-directed

written), and it used two independent scales (a: FAS and b: FSS) to assess fatigue symptoms in the same group. Troy et al.'s study examined morning fatigue (a) and evening fatigue (b).

Figure 6

Forest plots for meta-analysis of physical therapy on postintervention fatigue scores.

A: Fatigue scores at postintervention

B: Depression scores at postintervention

C: Fatigue scores at 2-week follow-up

D: Depression scores at 2-week follow-up

Figure 7

Forest plots for the effect of drinking tea on fatigue at postintervention (A), depression at postintervention (B), fatigue scores at the 2-week follow-up, (C) and depression scores at the 2-week follow-up (D).

Supplementary Files

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- [Additionalfile1PRISMA2009checklist.doc](#)
- [Additionalfile2Thefinalsearchstrategies.docx](#)