

Citation: Abera M, Hanlon C, Daniel B, Tesfaye M, Workicho A, Girma T, et al. (2024) Effects of relaxation interventions during pregnancy on maternal mental health, and pregnancy and newborn outcomes: A systematic review and metaanalysis. PLoS ONE 19(1): e0278432. https://doi. org/10.1371/journal.pone.0278432

Editor: Daniel Ahorsu, The Hong Kong Polytechnic University, HONG KONG

Received: November 15, 2022

Accepted: December 23, 2023

Published: January 25, 2024

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: https://doi.org/10.1371/journal.pone.0278432

Copyright: © 2024 Abera et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: All relevant data are within the manuscript and its <u>Supporting</u> Information files.

RESEARCH ARTICLE

Effects of relaxation interventions during pregnancy on maternal mental health, and pregnancy and newborn outcomes: A systematic review and meta-analysis

Mubarek Abera^{1*}, Charlotte Hanlon^{2,3}, Beniam Daniel⁴, Markos Tesfaye^{5,6}, Abdulhalik Workicho⁷, Tsinuel Girma⁸, Rasmus Wibaek⁹, Gregers S. Andersen⁹, Mary Fewtrell¹⁰, Suzanne Filteau¹¹, Jonathan C. K. Wells¹⁰

 Department of Psychiatry, Faculty of Medical Science, Jimma University, Jimma, Ethiopia, 2 Centre for Global Mental Health, Health Service and Population Research Department, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, 3 Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia, 4 School of Nursing, College of Medicine and Health Sciences, Arbaminch University, Arbaminch, Ethiopia, 5 NORMENT, Division of Mental Health and Addiction, Oslo University Hospital & Institute of Clinical Medicine, University of Oslo, Oslo, Norway, 6 NORMENT, Department of Clinical Science, University of Bergen, Bergen, Norway, 7 Department of Epidemiology, Faculty of Public Health, Jimma University, Jimma, Ethiopia, 8 Department of Pediatrics, Faculty of Medical Sciences, Jimma University, Jimma, Ethiopia, 9 Clinical Epidemiology Research, Steno Diabetes Center Copenhagen, Herlev, Denmark, 10 Population, Policy and Practice Research and Teaching Department, UCL Great Ormond Street Institute of Child Health, London, United Kingdom, 11 Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, United Kingdom

* mubarek.abera@ju.edu.et, abmubarek@gmail.com

Abstract

Background

Stress during pregnancy is detrimental to maternal health, pregnancy and birth outcomes and various preventive relaxation interventions have been developed. This systematic review and meta-analysis aimed to evaluate their effectiveness in terms of maternal mental health, pregnancy and birth outcomes.

Method

The protocol for this review is published on PROSPERO with registration number CRD42020187443. A systematic search of major databases was conducted. Primary outcomes were maternal mental health problems (stress, anxiety, depression), and pregnancy (gestational age, labour duration, delivery mode) and birth outcomes (birth weight, Apgar score, preterm birth). Randomized controlled trials or quasi-experimental studies were eligible. Meta-analyses using a random-effects model was conducted for outcomes with sufficient data. For other outcomes a narrative review was undertaken.

Result

We reviewed 32 studies comprising 3,979 pregnant women aged 18 to 40 years. Relaxation interventions included yoga, music, Benson relaxation, progressive muscle relaxation

Funding: National Institute of Health Research through the NIHR Global Health Research Group -NIHR134325 - NIHR200842 Wellcome Trust -222154/Z20/Z - 223615/Z/21/Z - Dr Charlotte Hanlon.

Competing interests: The authors have declared that no competing interests exist.

(PMR), deep breathing relaxation (BR), guided imagery, mindfulness and hypnosis. Intervention duration ranged from brief experiment (~10 minutes) to 6 months of daily relaxation. Meta-analyses showed relaxation therapy reduced maternal stress (-4.1 points; 95% Confidence Interval (CI): -7.4, -0.9; 9 trials; 1113 participants), anxiety (-5.04 points; 95% CI: -8.2, -1.9; 10 trials; 1965 participants) and depressive symptoms (-2.3 points; 95% CI: -3.4, -1.3; 7 trials; 733 participants). Relaxation has also increased offspring birth weight (80 g, 95% CI: 1, 157; 8 trials; 1239 participants), explained by PMR (165g, 95% CI: 100, 231; 4 trials; 587 participants) in sub-group analysis. In five trials evaluating maternal physiological responses, relaxation therapy reduced duration of labour. Apgar score only improved significantly in two of six trials. One of three trials showed a significant increase in birth length, and one of three trials showed a significant increase in gestational age. Two of six trials examining delivery mode showed significantly increased spontaneous vaginal delivery and decreased instrumental delivery or cesarean section following a relaxation intervention.

Discussion

We found consistent evidence for beneficial effects of relaxation interventions in reducing maternal stress, improving mental health, and some evidence for improved maternal physiological outcomes. In addition, we found a positive effect of relaxation interventions on birth weight and inconsistent effects on other pregnancy or birth outcomes. High quality adequately powered trials are needed to examine impacts of relaxation interventions on newborns and offspring health outcomes.

Conclusion

In addition to benefits for mothers, relaxation interventions provided during pregnancy improved birth weight and hold some promise for improving newborn outcomes; therefore, this approach strongly merits further research.

Introduction

Stress, defined as "a state of mental discomfort, unpleasant feeling, worry or tension", when occurring during pregnancy is a major public health problem in low- and middle-income countries (LMICs), associated with adverse maternal health, pregnancy and birth outcomes [1, 2]. Stress occurs when a demand to deal with internal or external cues/stressors exceeds the coping skills and resilience of individuals [3]. Common stressors during pregnancy include physical stressors, such as illness and discomfort, changes in lifestyle, poor social support, unplanned pregnancy, low financial income, role transitions, hormonal and physiological changes, anticipation of labour and delivery, and intimate partner violence during and after pregnancy [4, 5]. Stress can be acute, episodic/transient or chronic, depending on the type and nature of stressors [6].

The human body stores unresolved psychological stress in the musculoskeletal system, mainly in the scalp, neck, back, chest, abdomen and extremities [7]. This can result in sustained contraction of the muscles which interferes with normal physiological functions [7]. The resulting stress response in the body involves psychological (mental, emotional or behavioral) and/or physiological responses (blood pressure, heart rate, respiratory rate and body temperature) [8]. Biologically, stress activates the Hypothalamus-Pituitary-Adrenal (HPA)

axis and the immune system through which it increases circulating glucocorticoids and proinflammatory markers [8]. Stress-induced glucocorticoid in the brain interferes with normal neurogenesis and synaptic plasticity leading to impaired functions of the nervous system which can result in mental illness [9–11]. This is recognized as the body-mind connection [12–14] whereby the body and the mind work together to maintain optimal psychological equilibrium and physiological homeostasis.

Stress during pregnancy can negatively impact maternal health and well-being [15] and generally increases the risk of non-communicable diseases such as hypertension, diabetes, cardiovascular problems, anxiety and depression [16]. Nearly one in three women globally [17], and more than half of women in LMICs experience stress during their pregnancy [17–20]. In Ethiopia, pregnant women experience higher levels of psychological stress compared to nonpregnant women and also exhibit lower resilience [18]. Globally, 15 to 25% of women experience high levels of anxiety or depressive symptoms during pregnancy [21, 22], with higher estimates from studies conducted in LMICs [22, 23]. Stress during pregnancy can affect the maternal immune system and increase the risk of infection and inflammatory diseases leading to maternal physical ill-health during and after pregnancy [8]. Antenatal stress and maternal mental disorders can adversely affect normal growth and development of the fetus and result in unfavorable pregnancy, obstetric and birth outcomes [15, 23, 24]. It can also influence the post-natal physical, mental and neurobehavioral health of the offspring, potentially leading to an increased risk of non-communicable diseases including mental illness later in life [24].

Several intervention modalities, including psychotropic medications, relaxation therapy and psychosocial and counseling therapies have been tested to reduce stress and improve the mental health of pregnant women [25]. Treatment of anxiety or depression with psychotropic medications during pregnancy or lactation carries potential risks for the mother and her offspring and has low acceptability [25]. Thus non-pharmacological interventions, such as counseling or relaxation therapies, are preferred for stress management during pregnancy [26, 27]. However, no comprehensive review of evidence is available on the effectiveness of relaxation interventions provided during pregnancy on maternal and neonatal health outcomes. This paper therefore aimed to systematically synthesize evidence on the effects of relaxation interventions on maternal stress and mental health during pregnancy and on pregnancy and birth outcomes.

Methods

Protocol registration

The protocol for this review was registered at PROSPERO International prospective register of systematic reviews and can be accessed at: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020187443.

Article selection

The review process followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guideline [28]. To identify relevant articles, a three-step search strategy was employed. In the first step, key free text and MeSH terms were identified and developed. Then a comprehensive search was conducted in the following major databases: PubMed, EMBASE Classic + EMBASE (Ovid), MEDLINE in-process and non-indexed citations, MED-LINE daily, and MEDLINE (Ovid), Cumulative Index to Nursing & Allied Health Plus (CINAHL via EBSCO) and the Cochrane library. In addition, a manual search was conducted to identify further relevant studies from the reference lists of identified studies. Unpublished and grey literature were excluded. The search terms were developed with a combination of key words relating to the study population, intervention types and outcome indicators, as follows. ("Pregnant women" OR "pregnancy" OR "prenatal" OR "prenatal care" OR "mother" OR "antenatal" OR "antenatal care" OR "maternal" OR "maternal care") AND ("Relaxation therapy" OR "Mindfulness therapy" OR "Progressive muscle relaxation (PMR) therapy" OR "Music therapy" OR "Exercise therapy" OR "deep breathing relaxation therapy" OR "Meditation therapy" OR "hypnosis therapy" OR "relaxation lighting"), AND ("Stress" OR "distress" OR "anxiety" OR "depression" OR "Birth-weight" OR "birth weight" OR "birth outcome" OR "Apgar", "Apgar score", "Gestation", OR "Gestational age at birth").

Studies were eligible if they employed Randomised Controlled Trial (RCT) or quasi-experimental designs, applied a relaxation intervention during pregnancy or labour, were published in English, and reported one or more of the outcomes of interest specified in our search strategy. Observational studies (case reports, cross-sectional and cohort studies) and editorials or opinion pieces were excluded.

PICO. Population: apparently healthy pregnant women.

Intervention/exposure: stress reduction relaxation therapy. Any form of relaxation intervention, whether mind-based (tapes, music, meditation) or physical/body-based (massage, stretch or exercise) including progressive muscle relaxation (PMR) and deep breathing exercises, that were applied during pregnancy with the aim of reducing stress and promoting mental health.

Comparators/controls: pregnant women who did not receive a stress-reduction relaxation intervention but who received treatment as usual.

Outcomes: the main outcomes were measures of stress (self-report, physiological or biochemical), mental health problems (anxiety or depressive symptoms), obstetrics/pregnancy outcomes (gestational age, mode of delivery, duration of labour), birth outcomes (birth weight, birth length, Apgar score) and maternal physiology (vital signs).

Timing of outcome measures: studies that measured the outcome during, immediately after, or some weeks or months after the intervention were included.

Study screening process. The literature search was concluded on 26 August 2023. To decide on inclusion, the articles were first screened by title and then by abstract using the eligibility criteria. Full texts of the selected articles were then assessed based on the inclusion and exclusion criteria. Two authors (MA and BD) screened all articles for eligibility. Any queries were discussed with one additional author (AW) to reach a consensus. The screening process and reasons for exclusion are documented.

Methodological quality assessment. Two independent assessors (BD and MA) evaluated the methodological quality of studies in terms of randomization, masking and availability of descriptions for withdrawal and dropout of all participants based on the modified Jadad scoring scale [29] and the modified Delphi List Criteria [30] to assess the overall quality of the studies. Using the Cochrane Collaboration's Assessment checklist [31], the risk of bias was assessed and rated as low, high or unclear for individual elements relating to five domains (selection, performance, attrition, reporting and other). The criterion on blinding was excluded as it is usually impossible to conduct relaxation therapy while blinding the participant or the care providers. S1 Table shows risk of bias assessment for all included studies.

Data extraction

The findings were extracted using a standard data extraction form prepared by the study team. Data were extracted in two phases. In the first phase, citation details (author name, publication year, design, sample size, setting, population, intervention, comparison and outcomes) were extracted. In the second phase, the intervention results by group were extracted.

Strategy for data synthesis

To obtain the pooled effects of the interventions, we conducted meta-analysis on the following outcomes for which there were an adequate number of studies with sufficiently 'similar' outcomes that could be pooled meaningfully: maternal stress, anxiety, depressive symptoms and birth weight (BW). We used the mean difference (MD) with the reported Standard Deviation (SD) of the outcome as a measure of effect size for each of the included studies. For the metaanalysis, the raw mean difference (D), with 95% CI across studies that measured the same outcome (depression with Edinburgh Postnatal Depression Scale (EPDS) or stress with Perceived Stress Scale (PSS), anxiety with State-Trait Anxiety Inventory (S-TAS) and birth weight in grams) was examined and presented. Sub-group analyses were performed to examine the existence of significant differences among studies that used different relaxation methods for any given outcome of interest. We assessed heterogeneity with the Cochrane's Q test and tausquared (T^2) and measured inconsistency (the percentage of total variation across studies due to heterogeneity) of effects across relaxation interventions using the I^2 statistic. Publication bias was assessed using regression based on Egger's test. For all meta-analyses, random effects model using restricted maximum likelihood estimates (REML) were employed. Statistical significance was defined as P < 0.05. Stata version 16 software (College Station, Texas 77845 USA) was used for the meta-analyses and for visualizing the forest plots.

For outcomes where meta-analysis was not possible because of inadequate number of studies and small sample size, a narrative synthesis of the reviewed articles on the effect of the interventions on each outcome of interest was performed and reported. S2 Table shows the preferred reporting items for systematic review and meta-analysis we followed to report the findings.

Results

Search results: Final reviewed studies

A total of 32 studies were included in the systematic review. See Fig 1 for the flow diagram.

Four of the reviewed studies were quasi-experimental [32–35] and one was a non-randomized clinical trial [36]. The remaining 27 studies were RCTs. Among the 27 RCTs, 9 trials reported on maternal perceived stress during pregnancy using PSS [37–45], 13 trials reported on anxiety during pregnancy using the State-Trait Anxiety Inventory (S-TAI) [37, 38, 40, 42, 45–53], 7 trials reported on antenatal and postnatal depression using the Edinburgh Postnatal Depression Scale (EPDS) [32, 38, 44, 48, 49, 51, 54], and 8 trials reported on birth weight in grams or kilograms [33, 51, 55–60]. In addition, two trials reported the effects of antenatal relaxation on postnatal stress, anxiety and depression using the Depression, Anxiety and Stress Scale (DASS) [32, 34], three trials reported symptoms of maternal anxiety during labour and 24 hours postnatal using the Visual Analogue Scale for Anxiety (VAS-A) [54, 55, 61] and one trial reported anxiety using the pregnancy-related anxiety questionnaire [62]. Six trials reported on Apgar score [33, 51, 55–57, 60], three trials reported on gestational age (GA) [51, 58, 60], six trials reported on mode of delivery [33, 50–52, 55, 58], and four trials reported on duration of labour [50, 52, 55, 57].

Study context/settings

Four of the studies were from a lower middle-income countries (India = 3, Egypt = 1), 14 from upper-middle-income countries (China = 1, Thailand = 1, Indonesia = 1, Turkey = 2, Malaysia = 3, Iran = 6), and 14 were from high-income countries (HIC; United States of America = 2, United Kingdom = 1, Germany = 1, Switzerland = 1, Greece = 1, Spain = 3, Taiwan = 5).

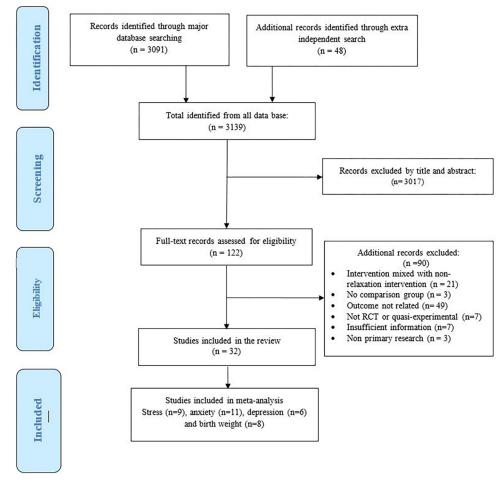


Fig 1. PRISMA flow chart showing literature search results and study selection process.

https://doi.org/10.1371/journal.pone.0278432.g001

Trials examining outcomes of maternal stress, anxiety or depressive symptom were from USA = 2, UK = 1, Switzerland = 1, Greece = 1, Turkey = 2, China = 1, Spain = 2, India = 3, Egypt = 1, Indonesia = 1, Malaysia = 2, Iran = 4 and Taiwan = 5. Trials on birth outcomes were from India = 1, Turkey = 1, Thailand = 1, Malaysia = 1, Spain = 1 and Iran = 3. There were no published studies from sub-Saharan Africa or from other Low-Income Countries (LIC).

Risk of bias within and across studies

Most studies had a low risk of selection, random allocation, concealment or other sources of bias. However, most studies had unclear risks on reporting bias (selective reporting of outcomes). <u>S1 Table</u> shows the risk of bias assessment findings for each of the studies.

Characteristics of relaxation methods

The reviewed articles used one or a combination of the following relaxation methods: yoga = 5, music = 12, PMR/BR = 8, mindfulness = 4, hypnosis = 3, Benson relaxation with music = 1 and Benson relaxation alone = 1. The duration of interventions ranged from as short as a 10-minute brief experimental intervention to 6 months of daily relaxation practice. Table 1 provides a detailed description and summary of information on the included studies.

Image: constraint of the constr	Authors, year	Study size	Country	Design	Relaxation, type and duration	Time outcome measured	Outcome			Results
0000 $000000000000000000000000000000000000$				1	applied			-	Relaxation	Control
	1. Bastani F, et al. 2005		Iran	RCT	Progressive muscle relaxation (PMR) and breathing exercise	Immeditely before and after the 7 th week of	Stress—percieved stress scale (PSS)	PSS points	24.4 ± 5.8	37.5 ± 5.7*
Image: constant of the consta					for 7 weeks between gestational age of 14 and 28 weeks	intervention. Made goup comparison	State anxiety—state anxiety trait inventory (S-STAI)	S-STAI points	22.7 ± 7.4	38.5 ± 5.7*
0500 010 010 01000 0100 0100							Trait anxiety: (T-STAI)	T-STAI, points	22.7±7.4	38.5 ±5.7*
Otional International support support (2010) International (2010) International (2010) <td>2. Bastani F, et al.</td> <td></td> <td>Iran</td> <td>RCT</td> <td>Progressive muscle relaxation</td> <td>Immeditely before and</td> <td>Birth weight (BW)</td> <td>grams</td> <td>3168 ± 42</td> <td>$2883 \pm 6^{*}$</td>	2. Bastani F, et al.		Iran	RCT	Progressive muscle relaxation	Immeditely before and	Birth weight (BW)	grams	3168 ± 42	$2883 \pm 6^{*}$
	2006				(PMR) and breathing exercise	after intervention and at	Low BW	n (%)	3 (5.8)	14 (26.9)*
Here (63)Here (64)Here (64)Here (64)Here (64)(10)(10)(63)HalHalHalHal(10)(10)(10)(10)(63)HalHalHalHal(10)(10)(10)(10)(10)(63)HalHalHalHal(10)(10)(10)(10)(10)(10)(63)HalHalHalHal(10)(10)(10)(10)(10)(10)(64)HalHalHalHal(10)(10)(10)(10)(10)(10)(10)(64)HalHalHalHalHal(10)<					age of 14 and 28 weeks	comparisons	Gestational age	week	38 ± 5.9	$38 \pm 4.40 \ddagger$
$ \left \begin{array}{cccccccccccccccccccccccccccccccccccc$					6		Preterm birth	n (%)	1 (1.9)	5 (9.8) ‡
(1, 1) $(1, 1)$ $(1, 1$							Mode of delivery; n (%)	Abnormal	11 (21.2)	25 (48.1)*
Image: bit in the sector of								SVD	41 (78.8)	27 (39.7)*
InternationalInternationalInternationalInternational $3 (5.6)$ <								C/S	8 (15.4)	21 (40.40)*
								Instrumental	3 (5.8)	4 (7.70)*
Cital Netset al33.6.0.00, 0.0.0 Magra conc. 1 ⁴ minute S.7.0 (%) 2.0.0 <t< td=""><td>3. Chuntharapat</td><td>EG:33</td><td>Thailand.</td><td>RCT</td><td>Yoga 1 hour weekly for 6</td><td>After intervention (at</td><td>Birth weight</td><td>grams</td><td>3076.8±311.2</td><td>3125.5±287.4‡</td></t<>	3. Chuntharapat	EG:33	Thailand.	RCT	Yoga 1 hour weekly for 6	After intervention (at	Birth weight	grams	3076.8±311.2	3125.5±287.4‡
Image: constant of the set	S, et al. 2008	CG:33			Weeks at 26–28th, 30th, 32nd, 34th 36th and 37th week of	birth) for group	Apgar score, 1 st minute	≤7; n (%)	2 (6.1)	5 (15.2) ‡
Appendix Appendix Section (b) Section (b) <t< td=""><td></td><td></td><td></td><td></td><td>gestation</td><td>companison</td><td></td><td>8-10; n (%)</td><td>31 (93.9)</td><td>28 (84.8) ‡</td></t<>					gestation	companison		8-10; n (%)	31 (93.9)	28 (84.8) ‡
Image: set of the set					6		Apgar score, 5th minutes	≤7; n (%)	0	‡ 0
Image: bold in the state in								8-10; n (%)	33 (100)	33 (100) ‡
interplationinterplationinterplationinterplationinterplationinterplation16TimeRefMusic Thengy provided dualPropose difference forRess PSS pointsPresent173-452Present173-452Present173-452Present173-452Present173-452PresentPresent173-452Present<							Length of labour, Minute	First stage	520 ± 19	$660 \pm 27^{*}$
Ec:InterchanceInterchanceSister<								Second stage	27 ± 15	31 ± 14
EG: 10.00 Tarken Bates: Tarken Pates: Tarken Intersection Intersection <thintersection< th=""> Intersection</thintersection<>								Total labour	559 ± 20	$684 \pm 28^{*}$
10 Description Description 15.3.5.2 Notes 15.3.5.2 Notes Notes<	4. Chang MY,	EG:	Taiwan	RCT	Music Therapy provided daily	Pre/post difference for	Stress: PSS, points	Pretest	17.4 ± 4.6	16·7 ±4·3
	et al. 2008	116			for 2 weeks	group comparison		Posttest	15.3 ± 5.2	15.8 ± 6.0
Image: short of the set of		120						Pre-post diff.	-2.1	-0.9*
							Anxiety: S-STAI, points	Pretest	37.9 ±9.8	37·1±10·0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$								Posttest	35.8 ± 10.9	37.8 ± 12.1
Between the b								Pre-post diff	-2.1	0.7*
							Depression -Edinburg postnatal	Pretest	12.1±3.5	12-2±3-9
							depression scale (EPDS), points	Posttest	10.3 ± 4.1	12.1 ± 4.6
EG:45IndiaRCTYoga daily in the 2 nd and 3 rd rumesterPre/post difference for groups comparisonStess: PSS points, group go th week of pregnancy15.9 ± 5.010CG:45CG:46KNusic threapy for 30 minutesgroups comparisondifference 36^{th} week of pregnancy 10.9 ± 4.9 10.9 ± 4.9 CG:60ChinaRCTMusic threapy for 30 minutesPre/post difference for threapy for 30 minutesAnxiety, STAI points, mean for pre/post difference for the pre/post difference for the difference for the di								Pre-post diff.	1.8	0.1*
Cd:45 Intensite Brougs comparison difference 36 th week of pregnancy 109 ± 4.9 100 ± 4.9 EG:60 China RCT Music therapy for 30 minutes Prepost difference for an acty if the received difference for and mean and SD for prepost and mean and SD for prepost and mean and SD for prepost difference reported difference reported for 10 birth. Prepost difference reported difference reported difference for and mean and SD for prepost difference reported difference di difference di difference difference difference difference di di	5. Satyapriya M,	EG:45	India	RCT	Yoga daily in the 2^{nd} and 3^{rd}	Pre/post difference for	Stress: PSS points, group	20 th week of pregnancy	15.9 ± 5.0	15.4±5.7‡
	et al. 2009	CG:45			trimester	groups comparison	difference	36 th week of pregnancy	10.9 ± 4.9	$17.3\pm 5.3^{*}$
EG:60ChinaRCTMusic therapy for 30 minutes on 3 consecutive days at admision for expected pretern birthPre/post difference for prepost difference reported prepost difference reported Pre-post difference reported 								Pre-post diff	5.0	-1.9*
CG:60 on 3 consecutive days at admission for expected preterm group comparison prepost and mean and SD for birth. postest 26.6 26.6 ch C, et al. EG1: Switzerland RCT Progressive Muscle relaxation Pre/post difference reported Pre-post diff. 1:11±5.8 2:11±5.8 2:11	6. Yang M, et al.	EG:60	China	RCT	Music therapy for 30 minutes	Pre/post difference for	Anxiety: STAI points, mean for	Pretest	40.7	41.9‡
ch C, et al.EG1:SwitzerlandRCTDepressive Muscle relaxationPre-post diff. -14.1 ± 5.8 ch C, et al.EG1:SwitzerlandRCTProgressive Muscle relaxationPre-post diff. -14.1 ± 5.8 13EG2:NitzerlandRCTPre-post of attention. Anxiety decreased equally in all three groups fr13EG2:NitzerlandRCTPre-post of attention. Anxiety decreased equally in all three groups fr13EG2:NitzerlandRCTMuscle treased of not differ significantly. I change of attention. Anxiety decreased equally in all three groups fr13CG:13TaiwanRCTMuscle threapy for 1 hourPosttet for groupLabour anxiety using Yisual 6.4 ± 3.0 YH, et al.EG3:0TaiwanRCTMuscle threapy for 1 hourPosttet for groupLabour anxiety using Yisual 6.4 ± 3.0 6.4 ± 3.0 YH, et al.EG:30TaiwanRCTMuscle threapy for 1 hourPosttet for groupLabour anxiety using Yisual 6.4 ± 3.0 6.4 ± 3.0	2009	CG:60			on 3 consecutive days at	group comparison	pre/post and mean and SD for the pre/post difference reported	Posttest	26.6	41.8*
ch C, et al.EG1:SwizerlandRCTProgressive Muscle relaxationPre/postItem supplicationItem supplic					birth		min brokow mining with the	Pre-post diff.	-14.1±5.8	$-0.1\pm 2.8^{*}$
YH, et al. EG:30 Taiwan RCT Music therapy for 1 hour Posttest for group Labour anxiety using Visual Latent phase 6.4 ± 3.0 CG:30 Taiwan RCT Music therapy for 1 hour comparison Analogue Scale (VAS-A), points Active phase 8.2 ± 2.3 CG:30 Latent and active phase Latent and active phase diff. -1.8	7. Urech C, et al. 2010	EG1: 13 EG2: 13 CG:13	Switzerland	RCT	Progressive Muscle relaxation and Guided imaginary experiment applied for 10 minutes only	Pre/post	State anxiety: S-STAI	Groups did not differ significantly post intervention. Anxiety decreas to post-relaxation,F(1,35) = 5.14, 1	y in change of state anx ised equally in all three p = .030*, d = .38	iety from pre to groups from pre-
CG:30 during labour comparison Analogue Scale (VAS-A), points Active phase 8.2 ± 2.3 Latent and active phase diff. -1.8	8. Liu YH, et al.	EG:30	Taiwan	RCT	Music therapy for 1 hour	Posttest for group	Labour anxiety using Visual		6.4 ± 3.0	$5.2 \pm 2.2 \ddagger$
-1.8	2010	CG:30			during labour	comparison	Analogue Scale (VAS-A), points		8.2 ± 2.3	$7.7 \pm 2.1 \ddagger$
								Latent and active phase diff.	-1.8	2.5*

A 111 DAVE VOAP	Childry Circo								
		(-	applied				Relaxation	Control
9. Simavli S, et al.	EG:67	Turkey	RCT	Music therapy during labour	Pre/post for group	Labour anxiety: VAS-A, points	Pretest	2.8 ± 0.4	2.7±0.4‡
2014					comparison		Latent phase	4.3 ± 0.8	$5.1 \pm 0.9^{*}$
							Active phase	8.47 ± 0.7	$9.4 \pm 0.7^{*}$
							Second phase	9.1 ± 0.6	$9.8\pm0.4^{*}$
							2 h after delivery	1.7± 0.3	$4.2 \pm 0.8^{*}$
						Birth weight	U	3375 ± 245	$3420 \pm 239 \ddagger$
						Apgar 9/10	u (%)	67 (100%)	61 (93.8%) +
						Duration of labour, Minutes	Latent phase	162 ± 15	$164 \pm 15 \ddagger$
							Active phase	189 ± 28	$198 \pm 15^{*}$
							Second phase	83 ± 13	$89 \pm 18^*$
							Third stage	17 ± 50	17 ± 5‡
						Mode of delivery; n (%)	Caesarian section	5 (6.9)	9 (12.2) ‡
						χ^2 test, P>0.05	Instrumental	2(2.7)	5 (6.8) ‡
							Spontaneous vaginal delivery	65 (90.2)	60 (81.0) ‡
							Episiotomy	51 (76.1)	52 (80.0) ‡
						Latent phase labour	SBP, mm Hg	106.0±13.1	$110.2\pm9.3^{*}$
							DBP, mmHg	66.3±4.9	$68.3\pm 3.8^{*}$
							Hear rate	76.0±4.8	$78.7\pm5.9^{*}$
						Active phase labour	SBP, mm Hg	99.7±12.3	$108.3\pm10.6^{*}$
							DBP, mmHg	62.7±5.1	68.3±3.8*
							Hear rate	74.4±4.9	78.7±5.8*
						Second stage labour	SBP, mm Hg	91.6±16.1	$101.1\pm9.1^{*}$
							DBP, mmHg	60.6±2.4	59.9±11.5‡
							Hear rate	73.9±3.8	76.5±3.7*
						2 h postpartum period	SBP, mm Hg	94.2±5.0	99.9±15.5*
							DBP, mmHg	59.4±2.4	$63.4\pm 10.7^{*}$
							Hear rate	72.1±3.9	$75.4\pm10.4^{*}$
10. Simavli S,	EG:71	Turkey	RCT	Music therapy during labour	Posttest group comparison	Antenatal depression: EPDS	Mean (SD) score	8.0 (2.8)	8.5 (2.6) ‡
et al. 2014	CG:70						EPDS≥10, n (%)	18 (25.4)	21 (30.0) ‡
							EPDS≥13, n (%)	8 (11.3)	9 (12.9) ‡
						Postnatal depression day 1	Mean (SD) score	7.3±2.4	$8.3\pm 2.8^{*}$
							EPDS>10, n (%)	11 (15.5)	22 (31.4)*
							EPDS≥13, n (%)	4 (5.6)	12 (17.1)*
						Postnatal depression: EPDS,	EPDS, points	7.1±2.1	8.6±2.9*
						day 8	EPDS≥10, n (%)	9 (12.7)	25 (35.7)*
							EPDS≥13, n (%)	4 (5.6)	13 (18.6)*
						Postnatal Anxiety: VAS-A	VAS-A (1 h)	3.3 ± 0.5	$4.9 \pm 0.9^{*}$
							VAS-A (4 h)	2.7±0.4	$4.2 \pm 0.8^{*}$
							VAS-A (8 h)	2.3 ± 0.3	$3.3\pm0.5^{*}$
							VAS-A (16 h)	1.7 ± 0.3	$2.8 \pm 0.4^{*}$
							VAS-A (24 h)	0.9 ± 0.6	$2.3\pm0.3^{*}$
11. Tragea C, et al.	. EG:31	Greece	RCT	Breathing and progressive	Pre/post difference for	Stress: PSS, points	Pre-post diff.	-3.7 ± 1.8	$-0.5\pm1.8^{*}$
2014	CG:29			muscle relaxation 1–2 times a	group comparison	Anxiety: S-STAI	Pre-post diff.	-3.5±2.8	-2.0±2.9 ‡
				day tot 0 weeks		Anxiety: T-STAI	Pre-post diff.	-38(14)	-16(25)±

Authore year	Study ciza	Counter	Dacim	Delevation true and duration	Time out come measured	Outcome			Deculte
the terminal of te	ormal area	COMING	Treagu	applied		O ULCOTTC		Dalanation	Cantant
12 Guardino CM		TISA	RCT	Mindfulness training	Dre/nost (immediate	DSS noints. Significant main	Dratact	41 8+6 0	39 9+8 6+
et al. 2014	CG:23	100	101		posttest and 6 weeks after	effect of time: $p < 0.05^*$	1 100001 Doctoot immediate	373454	36 040 04
					post test		Posttest 6 weeks	36.2+5.9	37 4+7 3±
						Anxiety: S-STAI: Significant	Pretest	45.7±7.6	44.4±11.0‡
						main effect of time: $p = 0.001^*$	Posttest immediate	39.7±6.3	37.4±11.5‡
							Posttest 6 weeks	38.1±8.8	36.2±10.8‡
13. Newham J,	EG:29	UK	RCT	Yoga training and practice	Pre/post difference for	Anxiety: S-STAI, Points,	Baseline	28(24-42)	32 (24-37)
et al. 2014	CG:22			applied for 8 weeks	group comparison	medians (IQR)	End line	27(22-36)	34 (25–38) ‡
						Anxiety: T-STAI, Points,	Baseline:	34 (29-40)	35 (33-39)
						medians (IQR)	End line:	34 (29–39	34 (30–41) ‡
						Depression: EPDS, Points,	Baseline:	5 (2-10)	5 (4-8)
						medians (IQR)	End line:	4 (2-7)	6 (3-10)*
						Anxiety: WDEQ	Baseline:	74 (62–87	77 (60-85)
							End line:	61 (42-77)	69 (58–78)*
14. Davis K, et al.	EG:23	USA	RCT	Yoga for 8 weeks	Pre/post, and midline	Depression: EPDS, points	Baseline	10.1 ± 4.5	10.6±5.1
2015	CG:23				assessment		Midline	8.5 ± 4.9	8.8 ±6.0
							End line	6.4 ± 4.0	7.3 ± 5.1
							Baseline-end line mean diff.	3.7	3.3‡
						Anxiety: S-STAI), points	Baseline	36.9 ± 12.2	41.7±10.8
							Midline	41.8±15.2	39.0±11.4
							End line	34.8±10.7	38.8 ±13.7
							Baseline-end line mean diff.	2.1	2.9‡
						Anxiety: T-STAI, points	Baseline	45.0 ± 12.1	45.4 ± 10.2
							Midline	43.1 ± 11.4	42.4±13.5
							End line	38.4 ±9.9	40.4 ± 10.9
							Baseline-end line mean diff.	6.6	5‡
15. Chang HC,	EG:	Taiwan	RCT	Music therapy during 2^{nd} and /	Pre/post for pre-post mean	Stress: PSS, points	Pretest	16.5±4.9	16.4±4.8
et al. 2015	145 CG			or 3 rd trimester	difference for group		Posttest	16.0 ± 5.6	16.4 ±5.3
	151				Thermolitica		Pre-post diff.	0.5	\$0
						STRESS: Pregnancy Stress	Pretest	53.7±24.1	49.9±22.3
						Rating Scale (PSRS)	Posttest	54.0±23.6	54.9 ± 22.7
							Pre-post diff.	0.3	4.8*
16. Liu YH, et al.	EG:61	Taiwan	RCT	Music therapy for 2 weeks	Pre/post	Stress: PSS, points	Pretest:	17.1 ± 5.4	16.3 ± 5.2
2016	CG:60						Posttest:	17.9 ± 4.1	19.3 ± 2.5
							Pre-pots mean diff. for group comparison	-0.8	-3.0*
						Anxiety: S-STAI, points	Pretest	39.7 ± 10.7	40.2 ± 10.2
							Posttest	37.3±10.0	42.1±11.6
							Pre-pots mean diff. group comparison	2.4	-1.9*

PLOS ONE | https://doi.org/10.1371/journal.pone.0278432 January 25, 2024

(Continued)

Matter Matter<	Matrix for any set of the set of										
Bits Bits Bits Bits Settististististististististististististis	EG:27 India RCT Multivision Mediation for 4 Serveds of the encollined in the A Served of the enc	Authors, year	Study Size	Country	Design	keiaxation, type and duration applied	I IINE OUICOME MEASUred	Outcome	4		Kesuits
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	CG37 CG31 Free rate of activity. Experimental responsing practical since 16 Preprint CG37 CG31 Free rate of activity. Experimental responsing practical since 16 Preprint CG31 Free rate of activity. Experimental responsing practical since 16 Preprint Experimental responsing practical since 16 Free rate results from responsing boold. Free responsing practical since 16 Free rate results results responsing practical since 16 Free rate results results responsing practical since 16 Free rate results results responsing results responsing results results results results results responsing results result	17.	EG:37	India	RCT	lness Meditation for 4	5 weeks after enrollment	Stress: PSS, points	Posttest between group	19.1±1.4	32.1±2.40*
Remark Benung Benung<	Bit Returning Returning EC33 Mahyai Quasi ceperimental Perpositi protecti diandi biola pressi Cold Presso ystali biola presso Cold Presso ystali biola pressi Cold Presso ystali biola pressi Cold Presso ystali biola presso Cold Presso presso Cold Presso ystali biola presso Cold Presso presso presso Cold Presso presso presso Cold Presso presso presso presso Cold Presso presso presso presso presso Cold Presso presso presso presso presso presso presso Cold Presso pres	Muthukrishnan S,	CG:37				(at 17–18 weeks of		comparison		
	EG3 Malosia Cuasi-seperimental legenosis practical since 16 Prepont: Prepont: Requisatory cata: Coal Preservations biood preservations denoted since 16 EG3 Malosia Quasi-seperimental sector of spatation: Prepont: Respiratory cata: coal Preservations biood preserva- tions biood preservations biood preserva- tions biood preservations biood preserva- bio coal Preservations biood preserva- tions biood preservations biood preserva- tions biood preservations biood preserva- bio coal Preservations biood preserva- need of spatation: Prespons: Respiratory cata: Respiratory cata: Coal Preservations biood preserva- tions biood preservations biood preserva- preservations biood biood biood biood bio	CI 41. 2010					gestation)	BP: mmHg	SBP	109.22±3.8	$124.68\pm5.6^{*}$
	Filt Filt <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>DBP</td><td>69.11±2.23</td><td>69.11±2.2‡</td></th<>								DBP	69.11±2.23	69.11±2.2‡
Result Additionation Internation	Filt Reponsite binol pressure EG23 Mahyna Quasi-experimental Etyposite binol pressure Etyposite binol pressure EG23 Mahyna Quasi-experimental Etyposite binol pressure Etyposite binol pressure EG23 Mahyna Quasi-experimental Etyposite binol pressure Etyposite binol pressure EG23 Mahyna Quasi-experimental Etyposite practice dance 16 Presposit: Press: Pr							Hear rate variability	Beats/min	26.59 ± 2.1	$20.65\pm1.5^{*}$
National Spatial Contractional cholor preserver response. 9, 00511 1, 0001 0, 00011	Kit Second							Respiratory rate	Breath/minute	$18.08\pm\!\!1.8$	$19.27\pm2.1^{*}$
Final synthesis of the synthesyntesis of the synthesis of the synthesis of the synthe	EG38 Malaysia Quait-experimental Hyponsiproticol diane (s event of genation) Economical diane (s event of genation) Economical diane (s event of genation) EG38 Malaysia Quait-experimental event of genation Hyponsiproticol diane (s event of genation) Economical diane (s event of genation) Economical diane (s event of genation) EG33 Malaysia Quast-experimental di advectori Hyponsiproticol diane (s event of genation) Economical diane (s event of genation) Economical diane (s event of genation) EG33 Malaysia Quast-experimental di advectori Hyponsiproticol diane (s event of genation) Economical diane (s event of genation) EG33 Spain RCT Malaysia Economical diane (s event of genation) Economical diane (s event of genation) EC Spain RCT Malaysia Economical diane (s event of genation) Economical diane (s event of genation) EC Spain RCT Malaysia Economical diane (s event of genation) Economical diane (s event of genation) EC Spain RCT Malaysia Economical diane (s event of genation) Economical diane (s event of genation) EC Bolone dia Malay event et							Cold Pressor systolic blood pressu	re response.	9.68±1.8	$13.38\pm 2.23^*$
Image: solution in the	EG38 Marysia Quasi-experimental Hyprosis practical diace 16 Perpose: Martal arthmetic sincatio blood J Recta arthmetic articatio blood J Anatyce DASS 21, points at 56 EG38 Marysia Quasi-experimental Hyprosis practical diace 16 Perpose: Netse 05 (gention and 36 weeks of gention and 36 weeks of there Perpose: Netse 05 (gention and 36 weeks of gention and 36 weeks of there Perpose: Perpos							Cold Pressor diastolic blood press	ure response.	4.19 ± 0.98	7.54±1.4*
	Efficient Manyar Constant arthmetic duratoric binearie Efficient Manyar Causi-coperimental Phynosis preticed since 16 Perpost: Stess: DAS-21, points at 56 Efficient Phynosis preticed since 16 Perpost: Perpost: Stess: DAS-21, points at 56 Efficient Pasi-coperimental Phynosis precied at 6, 20, 28 Perpost: Perpost: Efficient Pasi-coperimental Phynosis precied at 6, 20, 28 Perpost: Perpost: Efficient Pasi-coperimental Phynosis precied at 6, 20, 28 Perpost: Perpost: Efficient Pasi-coperimental Phynosis precied at 6, 20, 28 Perpost: Perpost: Efficient Pasi-coperimental Phynosis precied at 6, 20, 28 Perpost: Perpost: Efficient Spain RCT Manie theory for 40 minutes Perpost: Pasie core at 5 minute. Perpost: Efficient Spain RCT Manie theory for 40 minutes Perpost: Pasie core at 5 minute. Perpost: Pasie core at 5 minute.							Mental arithmetic systolic blood 	ressure response.	8.97±2.21	$13.49\pm3.1^{*}$
	EG38 Malysia Quasi-experimental hyponsi protical alter lo constant Proposi: protica every day until labour Proposi: protica every day until labour Bropsi: Alter Alter bypersion: DASS-31, points at 36 EG23 Malysia Quasi-experimental protica every day until labour Postext / done at birth and divider lo constant alter alte							Mental arithmetic diastolic blood	pressure response.	5.22±1.53	4.38±1.32 +
	CG234 ··· ··· week of gestation EC:22 Malysia Quasi-experimental Phynosis provided at 6, 20, 28, 21, points at 36 EC:22 Malysia Quasi-experimental Phynosis provided at 6, 20, 28, 21, points at 36 EC:22 Malysia Quasi-experimental Phynosis provided at 6, 20, 28, 21, points at 36 EC:22 Malysia Quasi-experimental Phynosis provided at 6, 20, 28, 21, points at 36 EC:23 Malysia Quasi-experimental Phynosis provided at 6, 20, 28, 21, points at 36 EC:23 Malysia Quasi-experimental Phynosis provided at 6, 20, 28, 21 EC:24 Spain McT Postet for group Postet 6 EC:3 Indometa Quasi experimental Advir 64 on intures Postet for group Postet 6 Z00 Spain MCT Advir 64 on intures Postet for group Postet 6 Postet 6 <t< td=""><td>18. Beevi Z, et al.</td><td>EG:28</td><td>Malaysia</td><td>Quasi-experimental</td><td>Hypnosis practiced since 16</td><td>Pre/post:</td><td>Stress: DASS-21, points at 36</td><td>Posttest mean group difference</td><td>5.8 ±5.4</td><td>$10.7 \pm 8.9^{*}$</td></t<>	18. Beevi Z, et al.	EG:28	Malaysia	Quasi-experimental	Hypnosis practiced since 16	Pre/post:	Stress: DASS-21, points at 36	Posttest mean group difference	5.8 ±5.4	$10.7 \pm 8.9^{*}$
Here EG23Here AnsistConstant also Constant and propudificanceE(1,4) = 107.9 = 401.7 (10,4) = 107.9 = 401.7EG23MalysisQasic eperiment and service resultPerpession DASS 1, points al (10,1) = 0.055.1, point al<	FIC Markey: DASS: 21, points at 5 EC:23 Markey: DASS: 21, points at 6 EC:23 Markey: DASS: 21, points at 6 EC:23 Spain EC:24 Markey: DASS: 21, points at 6 EC:25 Spain EC:25 Spain EC:25 Markey: DASS: 21, points at 6 EC:26 Spain EC:27 Markey: DASS: 21, points at 6 EC:28 Spain EC:29 Markey: DASS: 21, points at 6 EC:29 <td>2016</td> <td>CG:28</td> <td></td> <td></td> <td>week of gestation</td> <td></td> <td>weeks of gestation</td> <td>(raw data not given)</td> <td>F (1,44) = 4.70</td> <td>$\eta_{1}^{2} = 0.03$, partial $\eta^{2} = 0.01^{*}$</td>	2016	CG:28			week of gestation		weeks of gestation	(raw data not given)	F (1,44) = 4.70	$\eta_{1}^{2} = 0.03$, partial $\eta^{2} = 0.01^{*}$
EC:3MahyaCuest-experimentProvide freemineRetria megine to MSS-10, pointRetria megine to MSS-10, pointRetria megine and MSS-0.44.EC:3MahyaCuest-experimentHypensip proteket at 6, 20.3Provesip proteket at 6, 20.3SIDD.3.2.501.3SIDD.3.2.501.3EC:3MahyaCuest-experimentHypensip proteket at 6, 20.3Provesip proteket at 6, 20.3SIDD.3.2.501.3SIDD.3.2.501.3EC:3PointRetria wegint gSIDD.101.4SIDD.102.5SIDD.102.5SIDD.102.5EC:3SyainRetria wegint gSIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SyainRetria wegint gSIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SyainRetria wegint gSIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SyainRetria wegint gSIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SyainRetria wegint gSIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SiDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SiDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SiDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SiDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5EC:3SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5SIDD.102.5 <td< td=""><td>EG:23 Malysia Depression: DASS-21, points at the week of egention EG:23 Malysia Quasi-eperimental ad 5 vecks of their pack every day until labour Potnest / done at hith. Ether week of egention EG:23 Malysia Quasi-eperimental ad 5 vecks of their pack every day until labour Potnest / done at hith. Ether week of egention EG: Spain RCT Music therapy for 40 minutes Potnest for group Ether week of egention EG: Spain RCT Music therapy for 40 minutes Potnest for group Ether week of Apgar score at 5 minute EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest for group EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest for group EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest group EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes<!--</td--><td></td><td></td><td></td><td></td><td></td><td></td><td>Anxiety: DASS-21, points at 36 weeks of gestation</td><td>Posttest mean group difference (raw data not given)</td><td>F(1,44) = 10.7</td><td>$5, p = 0.01$, partial $\eta^2 = 0.20^*$</td></td></td<>	EG:23 Malysia Depression: DASS-21, points at the week of egention EG:23 Malysia Quasi-eperimental ad 5 vecks of their pack every day until labour Potnest / done at hith. Ether week of egention EG:23 Malysia Quasi-eperimental ad 5 vecks of their pack every day until labour Potnest / done at hith. Ether week of egention EG: Spain RCT Music therapy for 40 minutes Potnest for group Ether week of egention EG: Spain RCT Music therapy for 40 minutes Potnest for group Ether week of Apgar score at 5 minute EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest for group EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest for group EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest group EG: Indonesia Quasi experimental Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes Potnest group EG: Spain RCT Music therapy for 40 minutes </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Anxiety: DASS-21, points at 36 weeks of gestation</td> <td>Posttest mean group difference (raw data not given)</td> <td>F(1,44) = 10.7</td> <td>$5, p = 0.01$, partial $\eta^2 = 0.20^*$</td>							Anxiety: DASS-21, points at 36 weeks of gestation	Posttest mean group difference (raw data not given)	F(1,44) = 10.7	$5, p = 0.01$, partial $\eta^2 = 0.20^*$
EG.23MakysiaQusis experimental and sovies of them preduce very dy untilation preduce very dy untilation reguencies every dy untilation preduce very dy untilationReter / fore at initiate, is preduce very dy untilation preduce very dy untilationReter / fore at initiate, is preduce very dy untilation preduce very dy untilationReter / fore at initiate, is preduce very dy untilationReter / fore at initiate, i	EG:23 Malrysia Quasi-experimental and social concertice every day until labour Postnest / done at birth service at 1 minute, % Postnest / done at birth SYD, n (%) Entity weight SYD, n (%) CG:22 Spain RCT Musi-experimental and social of the service at 1 minute, % Postnest / done at birth SYD, n (%) Postnest / done at birth SYD, n (%) Postnest at 1 minute, % EG: Spain RCT Musi-therapy for 40 minutes and social of the service every day until labour Postnest for group Efficienties Appar score at 1 minute, % Z0: Spain RCT Musi-therapy for 40 minutes and social of the service Postnest for group Efficienties Appar score at 3 minute Z0: Spain RCT Musi-therapy for 40 minutes and social of the service Postnest for group Postnest for group Z0: Spain RCT Musi-therapy for 40 minutes and social of the service Appar score at 3 minute Postnest for a postneset for a postnest for a post							Depression: DASS-21, points at 36 weeks of restation	Posttest mean group difference	F(1,16) = 0.958,	$p = 0.342$, partial $\eta^2 = 0.6 + 0.64$
CG:2.2From the standard of the stand	CG: 22 T and 36 weeks or their programmery and advised or programmery and advised or programmery and advised or programmery advised or dialy for 2 weeks EV EV Topper score at 1 minute, % (%) EG: Spain RCT Music therapy for 40 minutes Posttest for group Birth weight EG: Spain RCT Music therapy for 40 minutes Posttest for group Birth weight EG: Spain RCT Music therapy for 40 minutes Posttest group Apgar score Apgar score EG: Spain RCT Music therapy for 40 minutes Posttest group Angar score EG: Spain RCT Music therapy for 40 minutes Posttest group Angar score EG: Spain RCT Music therapy for 40 minutes Posttest group On the of difference of diabut EG: Spain RCT Music therapy for 40 minutes Posttest group On the of difference Posttest group EG: Spain RCT Music therapy for 40 minutes Posttest group On the of differency divid Posttest group P	19. Beevi Z, et al.	EG: 23	Malaysia	Quasi-experimental	Hypnosis provided at 16, 20, 28,	Posttest / done at birth	Birth weight, g	3103.5±301.2		3070.9±367.24 ‡
$ \left \begin{array}{ccccc} & Eigender and advanced indust of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict every day until have a constant of the predict event if minute event if mi$	Field Program of a variation Content is one EG: Spain RCT Music therapy for 40 minutes Postnet for group Enth weight EG: Spain RCT Music therapy for 40 minutes Postnet for group Enth weight EG: Spain RCT Music therapy for 40 minutes Postnet for group Enth weight EG: Spain RCT Music therapy for 40 minutes Postnet for group Enth weight EG: Spain RCT Music therapy for 40 minutes Postnet for group Enth weight EG: Indonesia Quasi experimental Yooga 2 times in 2 weeks each Postnet group Ansiny Maings caore EG: Spain RCT Music therapy for 40 minutes Postnet group Ansiny Maings caore EG: Spain RCT Music therapy for 40 minutes Postnet group Ansiny Maings caore EG: Spain RCT Music therapy for 40 minutes Postnet group Ansiny Maings caore EG: Spain RCT Music therapy for 40 minutes Postnet group Maing for (1 minutes) EG: Spain RCT Music therapy for 40 minutes Postnet group Maing for (1 minutes) EG: Spain RCT Musi	2017	CG: 22			and 36 weeks of their		SVD, n (%)	19 (42.2)		14 (31.1) ‡
	E6: Spain RCT Music therapy for 40 minutes Posttest for group Rinth weight E6: Spain RCT Music therapy for 40 minutes Posttest for group Rinth weight 203 Sold Jain RCT Music therapy for 40 minutes Posttest for group Rinth weight 203 Sold Jain RCT Music therapy for 40 minutes Posttest for group Meedorm length 203 EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Ansiety (Amricher Hamilton 203 EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Ansiety (Amricher Hamilton 204 Spain NCT Music therapy for 40 minutes Posttest group Ansiety (Amricher Hamilton 205 Spain NCT Music therapy for 40 minutes Posttest group Ansiety (Amricher Hamilton 204 Spain NCT Music therapy for 40 minutes Posttest group Ansiety (Amricher Hamilton 205 Spain NCT Music therapy for 40 minutes Posttest group Ansiety (Amricher Hamilton Postteston 10					pregnancy and advised to practice every day until labour		C/S, n (%)	4 (8.9)		8 (17.8) \$
Four Four <th< td=""><td>E6: Spain RCT Music therapy for 40 minutes Posttest for goup Papar score at 5 minute E6: Spain RCT Music therapy for 40 minutes Posttest for goup Pinth weight 203 203 Music therapy for 40 minutes Posttest for goup Pinth weight 203 203 Music therapy for 40 minutes Comparison Meeborn length 203 E6:15 Indonesia Quasi experimental Yog 2 times in 2 weeks Comparison 203 E6:15 Indonesia Quasi experimental Yog 2 times in 2 weeks each Posttest goup Pinth weight 203 E6:15 Indonesia Quasi experimental Yog 2 times in 2 weeks each Posttest goup Pinth weight 204 CC1 Music therapy for 40 minutes Posttest goup Mastey family for 1 203 Fort Music therapy for 40 minutes Posttest goup Pintest family for 1 203 Fort Music therapy for 40 minutes Posttest goup Mode of talvery n (%), (%), (%), (%), (%), (%), (%), (%),</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Apgar score at 1 minute, %</td><td>5</td><td>0</td><td>4.3‡</td></th<>	E6: Spain RCT Music therapy for 40 minutes Posttest for goup Papar score at 5 minute E6: Spain RCT Music therapy for 40 minutes Posttest for goup Pinth weight 203 203 Music therapy for 40 minutes Posttest for goup Pinth weight 203 203 Music therapy for 40 minutes Comparison Meeborn length 203 E6:15 Indonesia Quasi experimental Yog 2 times in 2 weeks Comparison 203 E6:15 Indonesia Quasi experimental Yog 2 times in 2 weeks each Posttest goup Pinth weight 203 E6:15 Indonesia Quasi experimental Yog 2 times in 2 weeks each Posttest goup Pinth weight 204 CC1 Music therapy for 40 minutes Posttest goup Mastey family for 1 203 Fort Music therapy for 40 minutes Posttest goup Pintest family for 1 203 Fort Music therapy for 40 minutes Posttest goup Mode of talvery n (%), (%), (%), (%), (%), (%), (%), (%),							Apgar score at 1 minute, %	5	0	4.3‡
Eff: Balance	Ef: Spain RCT Music therapy for 40 minutes Posttest for group Rich weight 205 Spain RCT Music therapy for 40 minutes Posttest for group Rich weight 205 Sold Music therapy for 40 minutes Posttest for group Rich weight 205 Didonesia Quasi experimental Voga 2 times in 2 weeks each Posttest group Angar score EG:IS Indonesia Quasi experimental Voga 2 times in 2 weeks each Posttest group Ansely datify in (%), (%) EG:IS Indonesia Quasi experimental Voga 2 times in 2 weeks each Posttest group Ansely datify in (%), (%) 203 Spain RCT Music therapy for 40 minutes Posttest group Masely datify in (%), (%) 203 Spain RCT Music therapy for 40 minutes Posttest group Masely datify in (%), (%) 203 Spain RCT Music therapy for 40 minutes Posttest group Masely datify in (%), (%) 203 Spain RCT Music therapy for 40 minutes Posttest group Postest one follower 203 Spain RCT Music therapy for 40 minutes Posttest group Posttest one follower 203 Spain RCT Music therapy for 40 minutes <								9	0	4.3‡
Bit Bank Bank <th< td=""><td>Eff: Spain RCT Music therapy for 40 minutes Posttest for group Birth weight 203 204 205 Music therapy for 40 minutes Posttest for group Birth weight 203 203 203 Music therapy for 40 minutes Posttest for group Birth weight 203 203 Music therapy for 40 minutes Posttest for group Birth weight 203 CG: Quasi coperimental Voga 2 times in 2 weeks each Posttest group Anxiety (Amriety: Hamilton EG:15 Indonesia Quasi coperimental Yoga 2 times in 2 weeks each Posttest group Anxiety (Amriety: Hamilton EG:15 Indonesia Quasi coperimental Yoga 2 times in 2 weeks each Posttest group Music (Amriety: Hamilton EG:15 Indonesia Quasi coperimental Nusic therapy for 40 minutes Posttest group Music (Amriety: Hamilton 203 204 Music therapy for 40 minutes Posttest group Music (Amriety: Hamilton 204 Spain RCT Music therapy for 40 minutes Posttest group 205 Spain RCT Music therapy for 40 minutes Posttest group 205 Spain Music therapy for 40 minutes Posttest group 205 Maly for 2 weeks</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>8</td><td>4.3</td><td>18.2‡</td></th<>	Eff: Spain RCT Music therapy for 40 minutes Posttest for group Birth weight 203 204 205 Music therapy for 40 minutes Posttest for group Birth weight 203 203 203 Music therapy for 40 minutes Posttest for group Birth weight 203 203 Music therapy for 40 minutes Posttest for group Birth weight 203 CG: Quasi coperimental Voga 2 times in 2 weeks each Posttest group Anxiety (Amriety: Hamilton EG:15 Indonesia Quasi coperimental Yoga 2 times in 2 weeks each Posttest group Anxiety (Amriety: Hamilton EG:15 Indonesia Quasi coperimental Yoga 2 times in 2 weeks each Posttest group Music (Amriety: Hamilton EG:15 Indonesia Quasi coperimental Nusic therapy for 40 minutes Posttest group Music (Amriety: Hamilton 203 204 Music therapy for 40 minutes Posttest group Music (Amriety: Hamilton 204 Spain RCT Music therapy for 40 minutes Posttest group 205 Spain RCT Music therapy for 40 minutes Posttest group 205 Spain Music therapy for 40 minutes Posttest group 205 Maly for 2 weeks								8	4.3	18.2‡
NoteApparate or a finition900ECSpinRCTMast herapy for 40 minutesPostest for groupReth weight0100100ECSpinRCTMast herapy for 40 minutesPostest for groupNewborn lengthC34.40.434.40.4100205SpinRCTMast herapy for 40 minutesPostest for groupNewborn lengthCC34.24.634.40.4100205Mast herapy for 40 minutesPostest groupNewborn lengthCC34.24.634.24.6100205Mast herapy for 40 minutesPostest groupPostest groupNewborn lengthC90.90.91100.60ECSpinRCTMast herapy for 40 minutesPostest groupApparateore1 minute, New Order34.24.1100.60ECSpinRCTMast herapy for 40 minutesPostest groupNew Order follow100.00100.60100.60ECSpinRCTMast herapy for 40 minutesPostest groupNew Order follow100.60100.60100.60ECSpinRCTMast herapy for 40 minutesPostest groupNew Order follow100.60100.60100.60ECSpinRCTMast herapy for 40.60New Order follow100.60100.60100.60100.60ECMast herapy for 40.70New Order followNew Order follow100.60100.60100.60100.60ECMast herapy for 40.70New Order follow	EG: Spain RCT Music therapy for 40 minutes Postest for group Efrith weight 204 C03 Music therapy for 40 minutes Postest for group Efrith weight 204 Music therapy for 40 minutes Postest for group Efrith weight 205 Music therapy for 40 minutes Postest for group Efrith weight 205 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Postest group Angar score EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Postest group Angar score EG:15 Indonesia Quasi experimental Nasie therapy for 40 minutes Postest group Angar score EG:15 Spain RCT Music therapy for 40 minutes Postest group Angar score EG:15 Spain RCT Music therapy for 40 minutes Postest group Angar score EG:15 Spain RCT Music therapy for 40 minutes Postest group Onste of albour EG:16 Spain RCT Music therapy for 40 minutes Postest group comparison Postest for 90 minutes EG:17 Music therapolin o								6	95.7	72.7 *
Eff:100100100100100Eff:SpinKerthKerthKerthKerth100100100Eff:ParticleRendom lengthKerthKerth203-41.630-41.6100CCAllowerRendom lengthComparisonKerth203-41.6100100CCMaterVertexAlgar scoreImmute.0.01.40.9100100100EG:15IndonesiaQuast experimentalMater scoreSimmute.0.01.40.9100100100EG:15IndonesiaQuast experimentalMater scoreSimmute.0.01.40.9100100100100EG:15IndonesiaQuast experimentalMater scoreSimmute.100100100100100EG:15SpainKCTMater scoreSimmute.100100100100100100EG:15SpainKCTMater scoreSimmute.100100100100100100EG:15Mater scoreSimmute.Simmute.Simmute.100100100100100100100EG:15Mater scoreSimmute.Simmute.Simmute.100100100100100100100EG:15Mater scoreSimmute.Simmute.Simmute.Simmute.Simmute.100100100100100100100100100100100<	EC: Spain NCT Music therapy for 40 minutes Posttest for group Erch weight CG: 204 Comparison Newborn length Newborn length CG: 205 Apgar score Apgar score Apgar score 205 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Anxiety (Anxiety: Hamilton EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Anxiety (Anxiety: Hamilton EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Anxiety (Anxiety: Hamilton EG:15 Spain RCT Music therapy for 40 minutes Posttest group Anxiety (Anxiety: Hamilton 204 Spain RCT Music therapy for 40 minutes Posttest group Anxiety (Anxiety: Hamilton 204 Spain RCT Music therapy for 40 minutes Posttest group conprise Poststest Group Poststeore							Apgar score at 5 minute	6	0	4.5‡
EC:Spain bottomRefMake theraty for 4 minutesPostest for groupBirth weightKg $3.44.04$ $3.44.04$ $3.44.04$ 203	EC: Spain RCT Music therapy for 40 minutes Posttest for group Entrh weight 204 204 204 Newborn length Newborn length 205 205 204 Newborn length Newborn length 205 205 204 Newborn length Newborn length 205 205 204 Nasic vertice Apgar score 205 5pain RCT Music therapy for 40 minutes Posttest group Anxiety (Anxiety Hamilton) 204 100 100 100 100 100 100 EG: 5pain RCT Music therapy for 40 minutes Posttest group Anxiety (Anxiety Hamilton) 204 204 100 100 100 100 100 100 205 5pain RCT Music therapy for 40 minutes Posttest group comparison Inset of labour 100 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>10</td> <td>100</td> <td>95.5‡</td>								10	100	95.5‡
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	204 Comparison Newbornlength 205 205 Apgar score 205 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Ansiety Rating Scale), n (%); (r EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Ansiety Rating Scale), n (%); (r EG:15 Spain RCT Music therapy for 40 minutes Posttest group comparison: -9.83, p = 0.01)* EG:2 Spain RCT Music therapy for 40 minutes Posttest group comparison: -9.83, p = 0.01)* EG:2 Spain RCT Music therapy for 40 minutes Posttest group comparison -9.83, p = 0.01* 2.05 Malysia Quasi-experimental Music therapy for 40 minutes Posttest group comparison -9.83, p = 0.01* 2.05 Malysia Malysia Posttest group comparison -9.83, p = 0.01* -9.83, p = 0.01* 2.05 Malysia Posttest group comparison -9.83, p = 0.01* -0.01* 2.05 Malysia Posttest group comparison -0.83, p = 0.583, 1 -0.58, 21	20. Gonzalezet al.	EG:	Spain	RCT	Music therapy for 40 minutes	Posttest for group	Birth weight	Kg	3.4 ± 0.4	$3.4\pm0.5\pm$
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	OCU- DOC Image of content Appear score Image of content Appear score Image of content Appear score EG:15 Indonesia Quasi experimental Yoga 2 times in 2 weeks each Posttest group Anxiety Rating Scale, n (%); (%); (%); (%); (%); (%); (%); (%);	2017	204			daily for 2 weeks	comparison	Newborn length	Cm	50.3±1.86	50.6±2.0 ‡
EC:15Induces <th< td=""><td>EG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety (Anxiety: HamiltonEG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPosttest groupAnxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPosttest group comparison:a= 9.83, p = 0.01)*EG:26SpainRCTMusic therapy for 40 minutesPosttest group comparisonInst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonInst of fabour205MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Indone of deliveryin (%), posttest group comparisonEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Depresion: EDSEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 28Stress: DASS-21EG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 28Depresion: EDSEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 28Depresion: EDS<td></td><td>205</td><td></td><td></td><td></td><td></td><td>head circumference</td><td>Cm</td><td>34.5±1.3</td><td>34.6±1.4 ‡</td></td></th<>	EG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety (Anxiety: HamiltonEG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPosttest groupAnxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPosttest group comparison:a= 9.83, p = 0.01)*EG:26SpainRCTMusic therapy for 40 minutesPosttest group comparisonInst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonInst of fabour205MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Indone of deliveryin (%), posttest group comparisonEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Depresion: EDSEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 28Stress: DASS-21EG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 28Depresion: EDSEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 28Depresion: EDS <td></td> <td>205</td> <td></td> <td></td> <td></td> <td></td> <td>head circumference</td> <td>Cm</td> <td>34.5±1.3</td> <td>34.6±1.4 ‡</td>		205					head circumference	Cm	34.5±1.3	34.6±1.4 ‡
EG:15 Indonesia Indonesia Induction Spannet Spannet </td <td>EG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety (Amxiety: HamiltonEG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPosttest group comparison:Anxiety Rating Scale, n (%); (1EG:20SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonNost of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonPosttest group comparison205SpainRCTMusic therapy for 40 minutesPosttest group comparisonPosttest group comparison205MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 20Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experim</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Apgar score</td> <td>1 minute,</td> <td>9.1±0.8)</td> <td>9.0±0.9 ‡</td>	EG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety (Amxiety: HamiltonEG:15IndonesiaQuasi experimentalYoga 2 timesin 2 weeks eachPosttest groupAnxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPosttest group comparison:Anxiety Rating Scale, n (%); (1EG:20SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonNost of fabour205SpainRCTMusic therapy for 40 minutesPosttest group comparisonPosttest group comparison205SpainRCTMusic therapy for 40 minutesPosttest group comparisonPosttest group comparison205MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 21Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, 20Distrest GroupDistrest GroupEG:28MalaysiaQuasi-experim							Apgar score	1 minute,	9.1±0.8)	9.0±0.9 ‡
EG:15InduceiaQuasi experimental lating 90 minutesYoga 2 times in 2 weeks each haviory Raing Scale.n (%): (%)Yes2 (13.3%)15 (100%)EG:15SpainRCTMusic therapy for 40 minutesPosttest group comparison $= -9.83$, $p = 0.01$, %No $2 (13.3%)$ $10 (066)$ EG:15SpainRCTMusic therapy for 40 minutesPosttest group comparison $0 mest of labourSpainateous1140 (68.63)0 (090)EG:20SpainRCTMusic therapy for 40 minutesPosttest group comparison0 mest of labourSpainateous1140 (68.63)0 (090)205CG:20Music therapy for 40 minutesPosttest group comparison(90, P < 0.01^*Spainateous1140 (68.63)0 (090)205Music therapy for 40 minutesPosttest group comparison(90, P < 0.01^*Spainateous1140 (68.63)0 (090)205Music therapy for 40 minutesPosttest group comparison(90, P < 0.01^*Nobur9 (24.02)126 (2.3)205Music therapy for 40 minutesPosttest group comparisonRisk and Risk (Francine ($	EG:15IndonesiaQuasi experimentalYoga 2 times in 2 weeks eachPositest groupAmxiety Rating Scale, n (%); (1EG:15SpainRCTMusic therapy for 40 minutesPositest group comparison:Amxiety Rating Scale, n (%); (1EG:20SpainRCTMusic therapy for 40 minutesPositest group comparisonOnes (of labour204CG:Music therapy for 40 minutesPositest group comparisonOnes (of labour205Amxiety Rating Scale, n (%), (2)Positest group comparisonDes (of labour205Amxiety Rating Scale, n (%), (2)Positest group comparisonDes (of labour205Amxiety Rating Scale, n (%), (2)Positest group comparisonPositest group comparison205Amxiety Rating Scale, n (%), (2)Positest group comparisonPositest group comparison205MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, (3D)Bertering and 36 weeks of theirEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, (3D)Bertering and 36 weeks of theirEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, (3D)Bertering and 20 weeks of theirEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, (3D)Bertering and 36 weeks of theirEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, (3D)Bertering and 36 weeks of theirEG:28MalaysiaQuasi-experimentalHypnosis provided at 16, 20, 28, (3D)Bertering and 36 weeks of theirEG:28M							Apgar score	5 minute,	9.9±0.3	$9.9 \pm 0.4 \ddagger$
CG15Image: comparisonAnxiety Rating Scale). n (%): (tNo13 (86.7%)0 (0%)EG:SpainRCTMusic therapy for 40 minutesPosttest group comparison 0.933 , $p = 0.01$, $%$ Spontaneous $140 (68.63)$ 0.00% EG:SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnser of labourSpontaneous $140 (68.63)$ 0.00% 205Music therapy for 2 weeksMusic therapy for 40 minutesPosttest group comparison 0.00% $5(2.5)$ 110 100 205Mode of felivery: n (%).CSMode of felivery: n (%).CS, n (%) $49 (24.02)$ $126 (2.5)$ $126 (2.5)$ $126 (2.5)$ 205MalysiaQusi-coperimentalHypnosis provided at 16, 20, 28.Ca n(m) posttest, group comparison $5.55.1$ 436 ± 3.7 206 ± 13.2 166 ± 13.2 EG:28MalysiaQusi-coperimentalHypnosis provided at 16, 20, 28.Ca nuntionErest. DASS-21 $5.55.1$ 1.3 ± 2.4 EG:28Postest or theirDepression: DASS-21 1.3 ± 2.4 1.3 ± 2.4 1.3 ± 2.4 1.3 ± 2.4	CG:15 Jasting 90 minutes comparison: Anxiety Rating Scale, n (%); (t EG: Spain RCT Music therapy for 40 minutes Posttest group comparison Ones of fabour 204 CG: Music therapy for 40 minutes Posttest group comparison Ones of fabour Mode of delivery: n (%), 205 Adily for 2 weeks Mode of delivery: n (%), Posttest group comparison Dise of delivery: n (%), 205 Adily for 2 weeks Posttest group comparison Dise of delivery: n (%), Posttest group comparison 205 Adily for 2 weeks Posttest group comparison Dise of delivery: n (%), Posttest group comparison 205 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Stress: DASS-21 EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Stress: DASS-21 EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Stress: DASS-21 EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnation Depression: DASS-21 Ed:28 Malay	21. Novelia S,	EG:15	Indonesia	Quasi experimental	Yoga 2 times in 2 weeks each	Posttest group	Anxiety (Anxiety: Hamilton	Yes	2 (13.3%)	15 (100%)
EG:SpainRCTMusic therapy for 40 minutesPostest group comparisonContSpontaneous140 (68.63)1204204daily for 2 weeks0 (%), $p < 0.01^{*}$ Simulated5 (2.5)1205205mode of delivery: n (%).Vaginal155 (75.9)1205205205205205120520520520520512052052052052051205205205205255112052052004206 of delivery: n (%).206 nulleted206 f.13.2420520520520522212052052004205206 f.13.2222205205206 f.13.22222220520522222222052052222222205205222222220520522222222052052222222205205222222220520522222222052052222222205205<	EG:SpainRCTMusic therapy for 40 minutesPosttest group comparisonOnst of labour204204aily for 2 weeksmode of delivery, n (%), p < 0.01*	et al. 2018	CG:15			lasting 90 minutes	comparison:	Anxiety Rating Scale), n (%): (t = -9.83, p = 0.01)*	No		0 (0%)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	204 204 n (%),p < 0.01*	22. Gonzalez et al.	EG:	Spain	RCT	Music therapy for 40 minutes	Posttest group comparison	Onset of labour	Spontaneous	140 (68.63)	111 (54.2)
$ \frac{1}{205} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	205 205 205 Mode of delivery; n (%), P = 0.58‡ 205 Mode of delivery; n (%), Postes, goup comparison 205 Malaysia 205 Malaysia 205 CG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, Pregnancy and advised to pregnancy and advised to 205 Depression: EPDS	2018	204			daily for 2 weeks		$n (\%), p < 0.01^*$	Stimulated	5 (2.5)	12 (5.9)
$ \left. \left. \begin{array}{c c c c c c c c c c c c c c c c c c c $	EG:28 Malaysia Mode of delivery; n (%), P = 0.58‡ E3:28 Malaysia Eabour duration E3:28 Malaysia Cuasi-experimental F3:28 Malaysia Quasi-experimental F3:28 Malaysia Cuasi-experimental F3:28 Cuasi-experimental Manation F3:28 Cuasi-experimental Cuasi-experimental F3:28 Cuasi-experimental Cuasi-experimental F3:28 Cuasi-experimental Cuasi-experimental F3:28 Cuasi-experimental Cuasi-experimental F3:28 Cuasi-experimental Cuasi-experinteretorinteretor for proteretore for protectore <		205						Induced	59 (28.9)	82 (40.0)
$[3.2.3]{\label{eq:constants}} \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	EG:28 Malaysia P = 0.58‡ EG:28 Malaysia Panie duration EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, CG:28 P = 0.58‡ P = 0.58‡ P = 0.58‡ P = 0.58‡ P = 0.58‡ P = 0.58 P = 0.58							Mode of delivery; n (%),	Vaginal	155 (75.9)	151 (73.7)
Image: Relation for the state s	EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Iabour duration EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Arrisery: DASS-21 EG:28 Malaysia Quasi-experimental Bypnosis provided at 16, 20, 28, 2 month postnatal mean Arrisery: DASS-21 EG:28 Malaysia Quasi-experimental Pregnancy and advised to comparison Depression: DASS-21							P = 0.58	C/S, n (%)	49 (24.02)	54 (26.3)
Here Here State-Trait-Anxiety (STA); STA, points 30.6±13.2 43 EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Stress: DASS-21 5.5±5.1 30.6±13.2 43 EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Stress: DASS-21 5.5±5.1 30.6±13.2 43 CG:28 Malaysia Quasi-experimental Biodifference for group Anxiety: DASS-21 2.9±3.0 30.6±13.2 35 CG:28 Procession: DASS-21 1.3±2.4 1.3±2.4 35 35 35 36 36	EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20. 28, 2 month postnatal mean Strate-Trait-Anxiety (STA); postlest, group comparison EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20. 28, 2 month postnatal mean Stress: DASS-21 CG:28 Malaysia Quasi-experimental Finature and advised to comparison Stress: DASS-21 Pregnancy and advised to pregnancy and advised to pregnancy and advised to pregnancy and advised to comparison Depression: DASS-21							Labour duration	First stage, hours	4.36 ±3.7	$5.54 \pm 4.8^{*}$
EG:28 Malaysia Lemination Hypnosis provided at 16, 20, 28, 2month postnatal mean posttest, group comparison posttest	EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, and 56 weeks of their Imonth postnatal mean prostness: DASS-21 CG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, and 56 weeks of their (SD) difference for group Anxiety: DASS-21 CG:28 Pregnancy and advised to pregnancy and advised to comparison Depression: DASS-21 Depression: EPDS Depression: EPDS							State-Trait-Anxiety (STA);	STA, points	30.6±13.2	$43.1\pm15.0^*$
EG:28 Malaysia Quasi-experimental presented Hyprosis provided at 16, 20, 28, 2 month postnatal mean and 36 weeks of their CG:28 Zonoth postnatal mean Anxievy: DASS-21 5.54:5.1 Solution CG:28 Quasi-experimental and 36 weeks of their presentor and advised to practice every day until labour (SD) difference for group Depression: DASS-21 5.54:5.1 38 CG:28 Practice every day until labour comparison Depression: DASS-21 1.34:2.4 38	EG:28 Malaysia Quasi-experimental Hypnosis provided at 16, 20, 28, 2 month postnatal mean Stress: DASS-21 CG:28 Analeysia Quasi-experimental Hypnosis provided at 16, 20, 28, 28, 20 Image: Comparison Anxiety: DASS-21 CG:28 and 36 weeks of their (SD) difference for group Anxiety: DASS-21 pregnancy and advised to comparison Depression: DASS-21 pregnancy and advised to comparison Depression: DASS-21							posttest, group comparison			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	CU:20 Understanding the comparison of group Anxiety: DASS-21 Pregnancy and advised to comparison Depression: DASS-21 Depression: DASS-21 Depression: EPDS	23. Beevi Z, et al.	EG:28	Malaysia	Quasi-experimental	Hypnosis provided at 16, 20, 28,	2 month postnatal mean	Stress: DASS-21	5.5±5.1		3.6±5.1 ‡
Depression: DASS-21 1.3± 2.4 Depression: EPDS 5.7±2.8	Depression: EPDS Depression: EPDS	6107	CG:28			and 56 weeks of their pregnancy and advised to	(5D) difference for group comparison	Anxiety: DASS-21	2.9±3.0		$38.4\pm 58.8^{*}$
5.7±2.8						practice every day until labour		Depression: DASS-21	1.3±2.4		6.7±5.7*
								Depression: EPDS	5.7±2.8		$10.6\pm4.0^{*}$

A IIT DOPS. VPAP	Study size	Conntry (Desion	Kelayation, type and duration	Time outcome measured	Outcome			Results
			0	applied				Relaxation	Control
24. Pan Win Lan,	EG:39	Taiwan	RCT	Mindfulness based Programs:	Baseline and 3mo	Stress: PSS, points	Pretest	15.4(5.7)	13.8(6.0)
et al. 2019	CG:35			Once every week for 8 weeks	postpartum, mean (SD)		Posttest	11.6 ± 6.1	14.3 ±5.2
							Pre-post diff	3.8	0.5*
						Depression: EPDS, points	Pretest	9.5±4.0	8.7±4.5
							Posttest	6.5 ± 4.5	8.8 ±3.4
							Pre-post diff	3	-0.1*
25. Ahmadi M,	EG:75	Iran	RCT	Progressive muscle relaxation/	Posttest between group	Length at birth	CM	52.1±3.6	$48.6\pm 3.4^{*}$
et al. 2019	CG:75			PMR	comparison	Birth weight	U	3400±0.5	$3200\pm0.6^{*}$
						Postpartum depression, day 1	Zung's Self-rating Depression Scale	56.5±0.5	57.1±0.6‡
						Postpartum depression, day 3	Zung's Self-rating Depression Scale	49.7±0.4	59.4±0.7*
						Postpartum depression, day 10	Zung's Self-rating Depression Scale	44±0.4	60.3±0.8*
26. Rajeswari S,	EG:	India	RCT	Progressive Muscle Relaxation	Posttest group comparison	Stress: Calvin Hobel scale:	Minimal; n (%)	0 (0.00)	0 (0.0)
et al. 2020	120			daily practice from 21/22 weeks		$P < 0.001^{*}$	Mild; n (%)	51 (41.6)	19 (15.2)
	119						Moderate; n (%)	67 (54.4)	71 (56.8)
							Severe: n (%)	5 (4.00)	35 (28.0)
							Overall stress;	40.5 ± 8.6	$77.6 \pm 8.9^{*}$
						Anxiety (S-STAI)	Minimal; n (%)	0 (0.0)	0 (0.0)
						Fisher exact test: $F3 = 17.80$, $D \ge 0.001$ *	Mild; n (%)	22 (17.9)	9 (7.2)
						r < 0.001	Moderate; n (%)	97 (78.9)	84 (67.2)
							Severe; n (%)	4(3.2)	32 (25.6)
						Anxiety (T-STAI)	Minimal; n (%)	0 (000)	0 (0.0)
						Fisher exact test: F3 = 18.60, $D \ge 0.001^{\circ}$	Mild; n (%)	24 (10.0)	10 (8.0)
						r < 0.001	Moderate; n (%)	95 (83.0)	83 (66.4)
							Severe; n (%)	4 (3.0)	32 (25.6)
						Overall anxiety: (STAI)	Minimal; n (%)	0 (0.0)	0 (0.0)
						Fisher exact test: F3 = 19.80, $P < 0.001^*$	Mild; n (%)	26 (11.0)	11 (8.8)
						100.0 < 1	Moderate; n (%)	93 (82.0)	82 (65.6)
							Severe; n (%)	4 (32.0)	32 (25.6)
						Postpartum depression	EPDS, points	6.9 ± 2.5	$10.5 \pm 2.7^{*}$
						Gestational age, n (%)	Before 37 weeks	14 (11.5)	25 (20.3)
						$P = 0.01^*$	After 37 weeks	108 (88.5)	98 (79.7)
						Gestational age (weeks)		38.0±3.6	$37.2 \pm 4.2^{*}$
						Apgar score; n (%); fisher exact	0-3	0 (0.0)	3 (2.4)
						test: $P = 0.06$ ‡	4-6	2 (1.7)	10 (8.2)
							7-10	120 (98.3)	110 (89.4)
						Apgar score	Score/10	8.3 ±0.2	$8.0\pm0.6\ddagger$
						Birth weight	Kg	2.7 ±0.4	$2.6 \pm 0.5^{*}$
						Mode of delivery	Normal vaginal	90.0 (74.2)	61.0 (49.6)
						n (%): $P = 0.001^*$	Assisted vaginal	5.0 (4.0)	12.0 (9.8)
							C/S	27 (21.8)	50 (40.60)
						Induced labour	Yes, n (%)	110(9.0)	23 (20)
						$P = 0.019^{\circ}$	No, n (%)	111 (91.0)	100 (80.0)
						Hypertension	Yes, n (%)	4 (3.0)	12 (10.0)
						P = 0.03/	No, n (%)	118 (97)	111 (90)

				amhied					
								Kelaxation	Control
27. Zarenejad M, E	EG:30	Iran	RCT	Mindfulness: 6 group	Posttest group comparison	Pregnancy-Related Anxiety:	Pretest,	182.9 ± 74.2	195.1 ± 42.9
	CG:30			counseling sessions twice a		Posttest between group	Posttest immediate	154.5 ± 61.8	187.9 ± 41.5
				for 60 min		$P = 0.001^*$	Posttest 1 month later	124.9 ± 45.5	182.5 ± 41.7
	3G:40	Egypt	Non-randomized	Benson's Relaxation twice daily	Posttest group comparison	Stress: PSS, n (%)	Immediate posttest: $P = 0.01^*$	Yes 25 (62.5)	5) 40 (100)
FMH, et al. 2021 C	CG:40		controlled clinical	(separated by 3 hours) for 3					
			trial	days			Posttest after 3 days: $P = 0.01^*$		40
									5) 0 (0)
						Blood pressure: mmHg	SBP: Pretest	158.3±12.2	150.5±18.8*
							SBP immediate posttest	144.1±12.1	145.1±17.1‡
							SBP 3 days posttest	119.3±3.3	145.1±17.1*
							DBP pretest	95.2±11.2	90.8±12.2*
							DBP immediate posttest	87.8±9.5	87.4±9.8‡
							DBP 3 days posttest	77.0±4.6	87.4±9.8*
						Heart rate,	Pretest	92.3±7.2	97.8±16.3+
							Immediate posttest	87.4±6.1	$93.1\pm10.0^{*}$
							3 days posttest	81.2±3.8	$93.1 \pm 11.0^{*}$
						Respiration rate	Pretest	21.45±2.2	22.8±2.9*
							Immediate posttest	20.7±1.2	22.4±2.7*
							3 days posttest	18.6±1.2	22.4±2.7*
29. Bauer I, et al. E	EG1: 12	Germany	RCT	EG1: Music EG2: Guided	Pre/post	Indicators	Music group	GI group	Control group
	EG2: 12		(3-arm, parallel- group)	imagery (GI) CG: Resting		Cardiovascular activity on heart rate, 5 minutes posttest	-2.33±2.9	-1.9 ± 1.8	$-2.4\pm(3.4\pm)$
	CG: 12			Provided for 20 minute during labour		Cardiovascular activity on heart rate. 10 minutes posttest	- 2.5±5.6	-1.4±3.0	-2.6±4.3‡
						Heart rate variability	No significant group effect, F(2,94)	b = 0.624, b = .538	
						Skin conductance 5 minute	0.01+0.1	0 2+0 7	-0 1+ 0 5±
						posttest	1.0110.0	1.0 12.0	+C:0 =11:0-
						Skin conductance 10 minute posttest	−0.04±0.2	-0.7 ± 1.5	$-0.1\pm0.6\ddagger$
	3G1:	Spain	RCT	EG1:Music therapy and EG2:	Pre/post	Outcomes	Music	VR	Control
F, et al. 2022	104		3-arm parallel group	Virtual reality (VR)		First stage of labour, h	4.7±4.1	4.3±3.1	6.3±5.2*
	24			Intervention during labour		Spontaneous labour n (%)	50 (48.1)	103 (82.4)	59±51.8*
<u> </u>	CG: 115					Induction labour, n (%)	54 (51.9)	22 (17.6)	55 (48.2)*
						SVD, n (%)	49 (47.1)	73 (58.4)	56 (49.1) ‡
						Instrumental assisted, n (%)	21 (20.2)	32 (25.6)	26 (22.8) ‡
						C/S, n (%)	34 (32.7)	20 (16)	32 (28.1) ‡
						Pretest T-STAI	19.0± 6.9	19.2±7.1	19.8±7.4
						Posttest T-STAI	12.6±6.0	12.4±5.9	19.2±9.0
						Pre-post mean diff. (within	6.4*	6.8*	0.6‡
						Broup COLIPALISOLI) Drataset C. CTAI	16 3+5 8	16 646 8	16 5+4 8
						Posttest S-STAI	14.7+3.3	15.2+3.3	17.6 +7.2
						Pre-post diff (between group	1.6‡	1.3 #	-1.1 #
						comparison)			
						SBP	106.9±8.3	108.3 ± 9.8	$115.9\pm11.4^{*}$
						DBP	69.9±7.3	70.4±7.9	75.0±8.9*
						Heart rate	79.2±8.4	798+79	83 0+10 4*

Authors, year	Study size	Country	Design	Relaxation, type and duration Time outcome measured		Outcome			Results
				applied				Relaxation	Control
31. Abarghoee	EG1:	Iran	RCT	Benson Relaxation Technique	Pre/post within and	Anxiety: S-STAI; Pre-post	BRT group	MT group	CG
SN, et al. 2022	35 EC2.		(A parallel, three-	(BRT) and Music Therapy	between group	difference within group	Pre: 50.6±1.3	49.4±1.6	50.3±1.4
	35		armen	(11 TAT)	companison	companson	Post: 42.3±1.3	43.1±1.2	48.3±1.7
	CG:35						diff: 8.3*	diff: 6.3*	diff: 2.0‡
						Anxiety (S-STAI) pre/post	Pre: 50.6±1.3	49.4±1.6	50.3±1.4 ‡
						between group comparison	Post: 42.3±1.3	43.1±1.2	$48.3\pm1.7^{*}$
32. Ghorbanneja	EG: 44	Iran	RCT	Jacobson's progressive muscle	Posttest between group	Birth weight	U	2863.5±176.0	2762.7±202.1*
d S, et al. 2022	CG: 44			relaxation	comparison	Birth length	CM	47.8±2.1	47.5±2.2‡
						HC	CM	34.7±0.2	34.5 0.1‡
						Gestational age	Week	36.3±0.7	36.2 ± 0.8
						Apgar score	lst min	9.0±0.4	8.8±0.3‡
						BP: mmHg	SBP	137.6±3.9	$147.5\pm5.0^{*}$
							DBP	88.7±3.8	99.2±4.5*
						FBS	Mg/DI	101.8±6.8	$111.0\pm9.5^{*}$

Abbreviations: ACTH, Adrenocorticotropic hormone; BP, Blood pressure; CG, CM, Centimeter; Control group; C/S: Cesarean section; DASS-21, Depression, anxiety, stress scale- 21 items version; DBP, Diastolic blood pressure; EG, Experimental group; EPDS, Edinburgh postnatal depression scale; FBS, Fasting blood glucose; h, hour; HR, Heart rate; GI, Guided imaginary; IQR, Inter-quartile range; Kg, Kilogram; mg/dL, milligram per deciliter; Mo, Month; PSS, Perceived stress scale; Pre, pretest, post, posttest, diff, difference; RCT, Randomized control trial; SBP, Systolic blood pressure; SD, Standard deviation; S-STAI-S, State-trait anxiety inventory-state version; T-STAI, State-trait anxiety inventory-trait version; SVD, Spontaneous vaginal delivery; VAS, Visual analogue scale; WDEQ, Wijma delivery expectancy questionnaire-modified version.

Note

* P < 0.05

+ p = 0.05

 $\ddagger P \ge 0.05$

https://doi.org/10.1371/journal.pone.0278432.t001

Intervention outcomes

Maternal mental health. The effects of relaxation interventions on maternal mental health was examined in relation to symptoms of stress, anxiety or depression during the antenatal or postnatal periods.

Maternal stress. Nine trials (one of which reported stress at two time points) reported on the effectiveness of relaxation therapy on maternal stress symptoms using the PSS [37–45] and 2 trials using the DASS scale [32, 34]. Interventions applied were music therapy, meditation, mindfulness-based childbirth and parenting program, yoga, hypnosis, and PMR/BR.

A meta-analysis of the 9 trials (n = 1160 participants) using PSS mean and SD showed that relaxation interventions during pregnancy had a significant effect on reducing maternal perceived stress during pregnancy (overall mean difference (MD): -4.1; 95% CI: -7.4, -0.9)). In a subgroup analysis, only music therapy as a group significantly reduced maternal stress (MD: -.8, 95% CI: -1.53, -0.05), but not other relaxation methods. There was high level of heterogeneity among the studies ($I^2 = 97.8\%$, P<0.01). Output of the meta-analysis on stress is provided in Fig 2.

		Freatme			Contro			Mean diff.	Weight
Studies on stress	Ν	Mean	SD	Ν	Mean	SD		with 95% CI	(%)
Meditation									
Muthukrishnan et al., 2016	37	19.05	1.4	37	32.11	2.4		-13.06 [-13.96, -12.16]	10.41
							•	-13.06 [-13.96, -12.16]	
Mindfulness									
Pan et al., 2019	39	11.64	6.13	35	14.29	5.23		-2.65 [-5.26, -0.04]	9.83
Guardino et al., 2014a	24	37.3	5.4	23	35.8	8		1.50 [-2.39, 5.39]	9.12
Guardino et al., 2014b	24	36.2	5.9	23	37.4	7.3		-1.20 [-4.99, 2.59]	9.18
							-	-1.11 [-3.52, 1.29]	
Music									
Chang et al., 2015	145	15.97	5.62	151	16.38	5.25	-	-0.41 [-1.65, 0.83]	10.34
Liu et al., 2016	61	17.92	4.1	60	19.28	2.5	-=	-1.36 [-2.57, -0.15]	10.34
Chang et al., 2008	120	15.3	5.2	121	15.8	6	-	-0.50 [-1.92, 0.92]	10.29
							•	-0.79 [-1.53, -0.05]	
PMR/BR									
Bastani et al., 2005	55	24.4	5.8	55	37.5	5.7		-13.10 [-15.25, -10.95]	10.03
Tragea et al., 2014	31	-3.7	1.8	29	5	1.8		-3.20 [-4.11, -2.29]	10.41
						_		-8.10 [-17.80, 1.60]	
Yoga									
Satyapriya et al., 2009	45	10.88	4.97	45	17.33	5.34		-6.45 [-8.58, -4.32]	10.04
							-	-6.45 [-8.58, -4.32]	
Overall							-	-4.12 [-7.37, -0.88]	
Heterogeneity: τ^2 = 26.10, I ²	= 97.8	88%, H ²	² = 47.	20					
Test of $\theta_i = \theta_j$: Q(9) = 525.35	i, p = (0.00						Individual stud	
						-	15 -10 -5 0	 Subgroup ana 5 Overall analysis 	

Random-effects REML model

Fig 2. Forest plot and subgroup analysis for raw mean difference of studies on the effects of relaxation interventions on maternal stress measured using the perceived stress scale (PSS).

https://doi.org/10.1371/journal.pone.0278432.g002

Maternal anxiety. Anxiety symptoms were reported in 13 trials [37, 38, 40, 42, 45–53] using the STAI, two trials using the DASS [32, 34], three using the VAS-A scale) [54, 55, 61] and one using pregnancy related anxiety questionnaire [62].

Eleven of the 13 trials reported mean and SD using S-STAI (two of which reported anxiety at two time points). Meta-analysis of the 11 trials (n = 1965 participates) showed that relaxation interventions provided during pregnancy were effective in reducing symptoms of maternal anxiety (overall MD: -5.04; 95% CI: -8.2, -1.9). In a subgroup analysis, only music therapy as a group showed a significant effect in reducing anxiety by 6 points (MD: -5.8; 95% CI: -9.1, -2.4), but not other relaxation methods. The trials were highly heterogeneous ($I^2 = 97.1\%$, p < 0.01). The output of the meta-analysis on anxiety is provided in Fig 3.

The other 3 trials that were not included in the meta-analysis (because they did not reported mean and SD) were also effective in reducing symptoms of anxiety during pregnancy [34], labour [55, 61], and during the 24 hours [54] and 2 months postnatal [32] periods.

Maternal depressive symptoms. Seven trials examined effects of relaxation interventions provided during pregnancy on maternal depressive symptoms measured using the EPDS [32,

		Freatme			Contro			Mean diff.	Weight
Studies on anxiety	Ν	Mean	SD	Ν	Mean	SD		with 95% CI	(%)
Mindfulness									
Guardinoa et al., 2014a	24	39.7	6.3	23	37.4	11.5		2.30 [-2.97, 7.57]	6.82
Guardinoa et al., 2014b	24	38.1	8.8	23	36.2	10.8		1.90 [-3.72, 7.52]	6.65
							-	2.11 [-1.73, 5.96]	
Music									
Muthukrishnan et al., 2008	120	35.8	10.9	121	37.8	12.1		-2.00 [-4.91, 0.91]	
Yang et al., 2009	60	-14.1	5.8	60	1	2.8	-	-14.00 [-15.63, -12.37]	8.24
Liu et al., 2016	61	37.3	10	60	42.1	11.6		-4.80 [-8.66, -0.94]	7.49
González et al., 2018	204	30.6	13.2	205	43.1	15		-12.50 [-15.24, -9.76]	7.93
Abarghoee et al., 2022	35	43.1	1.2	35	48.3	1.7		-5.20 [-5.89, -4.51]	8.40
Chang et al., 2008	116	35.8	10.9	120	37.8	12.1		-2.00 [-4.94, 0.94]	7.85
Estrella-Juarez et al., 2022a	104	14.7	3.3	115	17.6	7.2	-	-2.90 [-4.41, -1.39]	8.27
Estrella-Juarez et al., 2022b	124	15.2	3.3	115	17.6	7.2	.	-2.40 [-3.80, -1.00]	8.29
							-	-5.75 [-9.11, -2.38]	
PMR/BR							_		
Bastani et al., 2005	55	22.7	7.4	55	38.5	5.7	-	-15.80 [-18.27, -13.33]	
Tragea et al., 2014	31	-3.5	2.8	29	-2	2.9	-	-1.50 [-2.94, -0.06]	8.28
								-8.61 [-22.63, 5.40]	
Yoga									
Davis et al., 2015	23	34.8	10.7	23	38.8	13.7		-4.00 [-11.10, 3.10]	5.90
								-4.00 [-11.10, 3.10]	
Overall							•	-5.04 [-8.19, -1.88]	
Heterogeneity: $\tau^2 = 30.69$, $I^2 =$	= 97.12	2%, H ² =	= 34.73	3			-		
Test of $\theta_i = \theta_i$: Q(12) = 282.64								Individual s Subgroup a	
						-2	20 -10 0	10	
						-4			.,

Random-effects REML model

Fig 3. Forest plot and subgroup analysis for raw mean difference of studies on the effects of relaxation interventions on antenatal anxiety score using S-TAI.

https://doi.org/10.1371/journal.pone.0278432.g003

38, 44, 48, 49, 51, 54]. Specific relaxation methods included in this section were yoga, Mindfulness-Based Childbirth and Parenting (MBCP) Music and PMR interventions.

Six of the 7 trials reported mean and SD using EPDS (one of which reported depression at two time points). Meta-analysis of the six trials (n = 933 participants) using EPDS mean and SD showed that relaxation interventions during pregnancy are effective in reducing maternal depressive symptoms (overall MD: -2.3; 95% CI: -3.4, -1.3) in the intervention compared to the control group. In a subgroup analysis, Music therapy as a group showed association with reduced depressive symptoms (MD: -2.2; 95% CI: -3.8, -0.06). The trials were found to be heterogeneous ($I^2 = 83.4\%$, P<0.01). The effects of relaxation interventions in improving depression also persisted to immediate one week postnatal [55] and the two month postnatal [32] period. Output of the meta-analysis on depressive symptoms is provided in Fig 4.

Newborn outcomes. Birth weight (mean, SD) as an outcome was reported in 8 trials [33, 51, 55–60]. The meta-analysis of the 8 trials (n = 1239 participants) indicated that relaxation interventions improved birth weight (overall MD = 80; 95% CI: 1, 157). Subgroup analysis showed that only PMR/BR, but not other relaxation methods, increased birth weight significantly (MD = 165; 95% CI: 100, 231) in the intervention compared to the control group. The subgroup analysis showed significant heterogeneity among the studies (I² = 63.0%, P = 0.03). Output of the meta-analysis on birth weight is provided in Fig 5.

Apgar score as outcome was measured in 6 trials [33, 51, 55–57, 60]. A study in Turkey reported 100% of neonates born to mothers in the relaxation group (music therapy) compared to 93.8% of neonates born to mothers in the control group scored 9/10 (p = 0.05) for Apgar

	-	Freatme	ent		Contro			Mean diff.	Weight
Studies on depression	Ν	Mean	SD	Ν	Mean	SD		with 95% CI	(%)
МВСР									
Pan et al., 2019	39	6.51	4.51	35	8.77	3.41		-2.26 [-4.10, -0.42]	12.01
								-2.26 [-4.10, -0.42]	
Music									
Chang et al, 2008	116	10.27	4 05	120	12 14	4.6	_	-1.87 [-2.98, -0.76]	15.66
Simavli, et al., 2008	70	7.3	2.4	71	8.3	2.8			16.81
	70	7.3	2.4	71					
Simavli et al., 2014b					8.6	2.9			16.92
Beevi et al., 2019	28	5.69	2.75	28	10.64	3.96			12.26
								-2.19 [-3.76, -0.62]	
PMR									
Rajeswari et al., 2020	120	6.9	2.45	119	10.54	2.71	-	-3.64 [-4.29, -2.99]	17.65
							•	-3.64 [-4.29, -2.99]	
Yoga									
Davis et al., 2015	23	6.35	3.99	23	7.32	5.06		-0.97 [-3.60, 1.66]	8.67
								-0.97 [-3.60, 1.66]	
Overall	0		0					-2.32 [-3.37, -1.27]	
Heterogeneity: $\tau^2 = 1.52$	2, $I^2 = 3$	83.42%	$, H^{2} =$	6.03				Individual stud	łv
Test of $\theta_i = \theta_j$: Q(6) = 38	3.22, p	= 0.00						Subgroup ana	
							-6 -4 -2	0 2 🔶 Overall analys	sis

Random-effects REML model

Fig 4. Forest plot and subgroup analysis for raw mean difference of studies on the effects of relaxation interventions on depressive symptoms using EPDS.

https://doi.org/10.1371/journal.pone.0278432.g004

		Treatme			Contro			Mean diff.	Weight
Studies on birth weight	Ν	Mean	SD	Ν	Mean	SD		with 95% Cl	(%)
Hypnosis									
Beevi et al., 2017	23	3103.5	301.2	22	3070.91	367.24		32.59 [-163.26, 228.44]	8.25
								32.59 [-163.26, 228.44]	
Music									
Simavli et al., 2014	67	3375.2	245	65	3420.1	239		-44.90 [-127.50, 37.70]	14.47
González et al., 2017	204	3380	420	205	3370	450		10.00 [-74.37, 94.37]	14.37
							+	-18.03 [-77.06, 40.99]	
PMR									
Bastani et al., 2006	55	3168	420	55	2883	640		— 285.00 [82.69, 487.31]	7.97
Rajeswari, et al., 2020	120	2710	390	119	2590	540		120.00 [0.65, 239.35]	12.29
Ghorbannejad et al., 2022	44	2863.5	176	44	2762.7	202		100.80 [21.64, 179.96]	14.66
Ahmadi et al., 2019	75	3400.5	48	75	3200	56		200.50 [183.81, 217.19]	17.15
							•	165.34 [100.09, 230.59]	
Yoga									
Chuntharapat et al., 2008	33	3076	311.22	33	3125.45	287.4		-49.45 [-193.98, 95.08]	10.83
							-	-49.45 [-193.98, 95.08]	
Overall							•	78.92 [1.10, 156.74]	
Heterogeneity: $\tau^2 = 9118.58$, I ² = 8	34.89%, H	$H^2 = 6.62$						
Test of $\theta_i = \theta_i$: Q(7) = 67.44,	p = 0	.00						Individual study	
	107					-2	00 0 200 400	0 600	
Random-effects REML mode	1							 Overall analysis 	

Fig 5. Forest plot and subgroup analysis for raw mean difference of studies on the effects of relaxation interventions on birth weight (g).

https://doi.org/10.1371/journal.pone.0278432.g005

score at 5 minute evaluation [55]. The trial in Malaysia reported a significant difference in Apgar score at 1 minute evaluation where 96% of neonates born to mothers in the relaxation (hypnosis) group scored 9 compared to 73% of neonates born to mothers in the control group [33]. The other trials showed no effect on Apgar score either at 1 or 5 minute evaluation [51, 56, 57].

Gestational age as an outcome was reported in three trials [51, 58, 60]. In India, relaxation significantly increased gestational age at birth (38.0 (\pm 3.6) weeks in the relaxation group vs 37.2 (\pm 4.2) weeks in the control group, *p* = 0.04). The same trial reported that the percentage of preterm births was significantly lower in the relaxation group (11.5%) compared to the control group (20.3%) (*p* = 0.01) [51]. However, studies in Iran reported no significant effect of relaxation therapy on gestational age, but the sample size for this trial was small [58, 60]. Newborn length at birth was reported in three trials; one of which reported increased birth length in the relaxation group (mean difference 3.5 centimetres; 95% CI: 2.4, 4.6) [59]; but not the remaining trials [56, 60].

Obstetric outcomes. Four RCTs assessed the effect of relaxation interventions on obstetric outcomes. In Turkey, women who received music therapy during labour had a significantly shorter mean (SD) duration of labour 189 (28) minutes in the first stage of active labour and 83 (13) minutes in the second stage of labour compared to 198 (15) minutes and 89 (18) minutes respectively in the control group [55]. In the same trial, women in the intervention group (music therapy) had non-significantly decreased rates of Cesarean section (6.8%), instrumental delivery (2.7%), episiotomy (76.1%), and non-significantly increased rate of spontaneous

vaginal delivery (90.2%) compared to 12.2% cesarean section, 6.8% instrumental delivery, 81% episiotomy and 80% spontaneous vaginal delivery in the control group [55]. A study from Iran reported a significantly reduced rate of abnormal delivery in the relaxation (PMR/BR) group (21.2%) compared to 48.1%, p = 0.01, and an increased rate of spontaneous vaginal delivery (78.8%) compared to 39.7%, p = 0.01, in the control group [58]. Similarly, there was a significant improvement in spontaneous vaginal delivery (74.2% in the PMR/BR compared to 49.6% in the control group) and a decreased rate of Caesarian deliveries (21.8% in the PMR/BR compared to 40.6% in the control group) in India [51]. The same trial reported a significantly decreased rate of induced labour in the PMR/BR group compared to women in the control group (F₂ = 5.50, p = 0.019) [51].

An RCT in Thailand also reported significantly shorter duration of first stage labour 520 (186) minutes vs. 660 (273) minutes (p<0.05) and shorter total duration of labour 559 (203) minutes vs 684 (276) minutes (p<0.05) in the yoga group compared to women in the control group [57].

Maternal physiological outcomes. Measurements of maternal physiological outcomes were reported in six studies [36, 43, 52, 55, 60, 63]. Pregnant women in the relaxation group had lower systolic and diastolic blood pressure, heart rate, respiration rate and skin conductance level activity during pregnancy, labour and the postnatal period [36, 43, 52, 55, 60, 63].

Discussion

In this systematic review and meta-analysis, we synthesized existing literature and provided up-to-date evidence on the effects of relaxation interventions during pregnancy on maternal mental health problems (stress, anxiety and depressive symptoms), and pregnancy and birth outcomes. Consistent beneficial impacts of relaxation interventions on mental health and birth weight outcomes were observed in terms of maternal stress, anxiety, depression and birth weight, although study heterogeneity was high. Furthermore, relaxation interventions consistently improved maternal physiological indicators during pregnancy and shortened the length of labour at birth. Findings on birth outcomes such as gestational age, mode of delivery, Apgar score and offspring birth length were mixed and non-conclusive. In subgroup analysis, music therapy has reduced symptoms of stress, anxiety and depression consistently and PMR/ BR relaxation improved offspring birth weight. Several mechanisms such as brain stem reflex, arousal, inducing emotions, mental imagery, conjure episodic memory and evaluative conditioning, could be involved in music therapy to improve mental health [64–66]. On the other hand, PMR/BR, through activation of cortical brain activities and by enhancing blood circulation and oxygen saturation, could optimize mental health and physiologic output [67–70].

The meta-analysis indicated that relaxation interventions are effective in reducing stress during pregnancy. One underlying mechanism can be explained by the model of body-mind connection and integration [71] whereby body, mind, brain and behavior are all interlinked and influence one another [72, 73]. Psychological stress leads to sustained contraction of muscle tissues making them tense with increased vasoconstriction, blood pressure, heart rate and decreased circulatory outcomes until the stress is resolved. Physical relaxation methods, such as breathing and muscle relaxation, further contract and then relax the muscle to expel the newly induced stress along with the preexisting pathological stress from the body. Another mechanism is that psychological relaxations such as meditation and music therapies relax the mind, induce emotions, mental imagery, and counter unpleasant feelings and thoughts to improve mental wellbeing.

In addition to their effects on stress, the meta-analysis showed that relaxation interventions are effective in improving symptoms of anxiety and depression. This could be explained by the

fact that anxiety and depression are mainly the consequence of increased and unresolved stress in human life [74, 75]. Increased level of stress activates the HPA axis as well as the sympathetic and parasympathetic nervous system [8, 74, 75] and influences the neuronal circuits responsible for regulating and mediating anxiety and depression in the brain [8, 74, 75]. Thus, by reducing stress, relaxation therapy could break the neurobiological links between stress, anxiety and depression. Another mechanism of relaxation is through its effect on improving neurogenesis, synaptogenesis and increased gray matter density and volume with potential benefit for optimizing neurotransmitters in the brain [76, 77].

In two trials in this review, the positive effects of relaxation in improving anxiety and depression persisted into the postnatal period. This enduring benefit of relaxation could arise because relaxation interventions prevent antenatal anxiety and depression which would otherwise persist into the postnatal period. Alternatively, the relaxation interventions provided during pregnancy may have a prolonged effect on maternal stress management and reduce the risk of anxiety and depression in the postnatal period. Improved maternal well-being during pregnancy helps the mothers to care for herself more optimally during pregnancy while persistence of better maternal mental health into the postnatal period could help mother-infant attachment, child care and exclusive breastfeeding, all of which promote positive growth and development of the offspring [78, 79].

Finally, in the meta-analysis, relaxation interventions showed a positive effect on birth weight of the newborn. This was entirely explained by the effect of progressive muscle relaxation and deep breathing on birth weight [51, 58–60], whereas no effect was seen for music, hypnosis or yoga therapies [33, 55–57]. This contrast could be because deep breathing and muscle relaxation rather than music therapy improve physical relaxation and optimized maternal physiology to improve uterine circulation, benefitting fetal growth and development. However, PMR/BR interventions were also given for longer periods compared to yoga and music therapies which could result in stronger effects compared to the other approaches.

In the narrative synthesis, studies that evaluated physiological responses found relaxation therapies to be effective in improving the physiology of pregnant women by optimizing vital signs such as blood pressure, heart rate, body temperature and respiration. Inconsistent effects of relaxation interventions on pregnancy and birth outcomes such as mode of delivery, gestational age, birth length and Apgar score were observed. The lack of associations in some of the outcomes could be because most of the reviewed studies were primarily powered to examine impacts on maternal mental health but not obstetric and birth outcomes. In addition, only a few trials reported gestational age and birth outcomes, compounded by a relatively small sample size.

In summary, the mechanisms through which relaxation interventions could improve maternal well-being, and pregnancy and birth outcomes could involve an interplay of physical, psychological and physiological mechanisms. Physical responses to relaxation include immediate musculoskeletal relaxation and a decrease in muscle tension; psychological responses include mental calmness, silence and peace; and physiological responses to relaxation include optimized blood pressure, heart rate, respiratory rate and metabolic rate, along with decreased stress hormones and increased blood circulation [80–84]. Through one or a combination of these mechanisms, relaxation interventions could improve the health and well-being of pregnant woman, and this in turn may support fetal growth and development of the offspring.

Strengths and limitations

A strength of this work is that we included trials that applied different forms of relaxation interventions and undertook both descriptive/narrative as well as pooled meta-analysis based

on data availability. However, the findings of the systematic review and meta-analysis also had some limitations. Most trials were primarily powered for maternal mental health, either stress, anxiety or depression, and not for pregnancy or birth outcomes. Because of lack of literature, some of the subgroup analysis involved only a single study. Furthermore, data on the effects of the relaxation interventions on neonatal outcomes other than birth weight were very limited and insufficient to conduct meta-analysis. Finally, most of the studies included in this review are from middle- or HIC and the findings might not be applicable for LIC settings, where both the sources of stress, and the feasibility of interventions, may be different.

Conclusion and recommendation

The results of this review indicate that, in addition to physiological and mental health benefits for mothers, relaxation interventions improved birth weight and hold some promise for improving other newborn outcomes; therefore, this approach strongly merits further research. Future research that is adequately powered on birth and newborn outcomes such as gestational age, birth weight and birth length is crucial. Considering the magnitude of perinatal maternal mental health and psychological problems, the high burden of obstetric complications and the associated global burden of maternal and neonatal morbidity and mortality, the results of this review indicate that a range of complementary interventions may help address these problems. Their relative cost-effectiveness, ease and absence of adverse and teratogenic effects in comparison to pharmacological treatments favours the application of one or a combination of these relaxation therapies in this population group. Relaxation interventions are low-intensity and may be more scalable than individualized psychological interventions in resource-limited settings.

Therefore, we recommend that these relaxation interventions be evaluated for their acceptability, suitability and effectiveness to improve maternal and offspring health outcomes in LICs. Further evaluating the interventions in these settings would also be beneficial to understand whether, in places with severe food insecurity and a high burden of infections, which affect both maternal and infant health, relaxation interventions could mitigate the harmful effects of stressors.

Supporting information

S1 Table. Quality assessment report for risk of bias for included studies in the review based on the Cochrane Collaboration's risk of bias assessment tool. (DOCX)

S2 Table. Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. (DOCX)

Author Contributions

Conceptualization: Mubarek Abera, Charlotte Hanlon, Markos Tesfaye, Abdulhalik Workicho, Mary Fewtrell, Suzanne Filteau, Jonathan C. K. Wells.

Data curation: Mubarek Abera, Beniam Daniel, Abdulhalik Workicho.

Formal analysis: Mubarek Abera, Beniam Daniel, Abdulhalik Workicho.

Methodology: Mubarek Abera, Charlotte Hanlon, Beniam Daniel, Markos Tesfaye, Mary Fewtrell, Suzanne Filteau, Jonathan C. K. Wells.

Project administration: Mubarek Abera, Jonathan C. K. Wells.

Supervision: Charlotte Hanlon, Jonathan C. K. Wells.

Visualization: Mubarek Abera.

Writing - original draft: Mubarek Abera.

Writing – review & editing: Mubarek Abera, Charlotte Hanlon, Beniam Daniel, Markos Tesfaye, Abdulhalik Workicho, Tsinuel Girma, Rasmus Wibaek, Gregers S. Andersen, Mary Fewtrell, Suzanne Filteau, Jonathan C. K. Wells.

References

- Dunkel Schetter C, Tanner L. Anxiety, depression and stress in pregnancy: implications for mothers, children, research, and practice. Curr Opin Psychiatry. 2012 Mar; 25(2):141–8. https://doi.org/10.1097/ YCO.0b013e3283503680 PMID: 22262028
- Alves AC, Cecatti JG, Souza RT. Resilience and Stress during Pregnancy: A Comprehensive Multidimensional Approach in Maternal and Perinatal Health. Cheng JT, editor. Sci World J. 2021 Aug 13; 2021:1–7. https://doi.org/10.1155/2021/9512854 PMID: 34434079
- Baqutayan SMS. Stress and Coping Mechanisms: A Historical Overview. Mediterr J Soc Sci [Internet]. 2015 Mar 1 [cited 2023 Aug 17]; Available from: <u>https://www.richtmann.org/journal/index.php/mjss/</u> article/view/5927
- Fisher J, Cabral De Mello M, Patel V, Rahman A, Tran T, Holton S, et al. Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. Bull World Health Organ. 2012 Feb 1; 90(2):139–149H. https://doi.org/10.2471/BLT.11. 091850 PMID: 22423165
- Saur AM, Dos Santos MA. Risk factors associated with stress symptoms during pregnancy and postpartum: integrative literature review. Women Health. 2021 Aug 9; 61(7):651–67. https://doi.org/10. 1080/03630242.2021.1954132 PMID: 34311677
- McEwen BS. Physiology and Neurobiology of Stress and Adaptation: Central Role of the Brain. Physiol Rev. 2007 Jul; 87(3):873–904. https://doi.org/10.1152/physrev.00041.2006 PMID: 17615391
- American Psychological Association (APA). Stress effects on the body. <u>https://www.apa.org/topics/stress/body</u>. Accessed: 8/17/2023.
- Godoy LD, Rossignoli MT, Delfino-Pereira P, Garcia-Cairasco N, De Lima Umeoka EH. A Comprehensive Overview on Stress Neurobiology: Basic Concepts and Clinical Implications. Front Behav Neurosci. 2018 Jul 3; 12:127. https://doi.org/10.3389/fnbeh.2018.00127 PMID: 30034327
- Vyas A, Mitra R, Shankaranarayana Rao BS, Chattarji S. Chronic Stress Induces Contrasting Patterns of Dendritic Remodeling in Hippocampal and Amygdaloid Neurons. J Neurosci. 2002 Aug 1; 22 (15):6810–8. https://doi.org/10.1523/JNEUROSCI.22-15-06810.2002 PMID: 12151561
- Popoli M, Yan Z, McEwen BS, Sanacora G. The stressed synapse: the impact of stress and glucocorticoids on glutamate transmission. Nat Rev Neurosci. 2012 Jan; 13(1):22–37.
- Pittenger C, Duman RS. Stress, Depression, and Neuroplasticity: A Convergence of Mechanisms. Neuropsychopharmacology. 2008 Jan; 33(1):88–109. https://doi.org/10.1038/sj.npp.1301574 PMID: 17851537
- Berrios GE. Historical epistemology of the body-mind interaction in psychiatry. Dialogues Clin Neurosci. 2018 Mar; 20(1):5–13. https://doi.org/10.31887/DCNS.2018.20.1/gberrios PMID: 29946206
- Brower V. Mind–body research moves towards the mainstream: Mounting evidence for the role of the mind in disease and healing is leading to a greater acceptance of mind–body medicine. EMBO Rep. 2006 Mar; 7(4):358–61.
- 14. Johnson M. The body in the mind.: The bodily basis of meaning, imagination, and reason. (1987). University of Chicago Press.
- Coussons-Read ME. Effects of prenatal stress on pregnancy and human development: mechanisms and pathways. Obstet Med. 2013 Jun; 6(2):52–7. https://doi.org/10.1177/1753495X12473751 PMID: 27757157
- Schneiderman N, Ironson G, Siegel SD. Stress and health: psychological, behavioral, and biological determinants. Annu Rev Clin Psychol. 2005; 1:607–28. <u>https://doi.org/10.1146/annurev.clinpsy.1</u>. 102803.144141 PMID: 17716101

- Pais M, Pai MV. Stress Among Pregnant Women: A Systematic Review. J Clin Diagn Res [Internet]. 2018 [cited 2023 Aug 15]; Available from: http://jcdr.net/article_fulltext.asp?issn=0973-709x&year= 2018&volume=12&issue=5&page=LE01&issn=0973-709x&id=11561
- Abera M, Hanlon C, Fedlu H, Fewtrell M, Tesfaye M, Wells JCK. Stress and resilience during pregnancy: A comparative study between pregnant and non-pregnant women in Ethiopia. Waqas A, editor. PLOS Glob Public Health. 2023 May 22; 3(5):e0001416. <u>https://doi.org/10.1371/journal.pgph.0001416</u> PMID: 37216320
- Woods SM, Melville JL, Guo Y, Fan MY, Gavin A. Psychosocial stress during pregnancy. Am J Obstet Gynecol. 2010 Jan; 202(1):61.e1–7. https://doi.org/10.1016/j.ajog.2009.07.041 PMID: 19766975
- 20. Vijayaselvi DrR. Risk Factors for Stress During Antenatal Period Among Pregnant Women in Tertiary Care Hospital of Southern India. J Clin Diagn Res [Internet]. 2015 [cited 2023 Aug 15]; Available from: http://jcdr.net/article_fulltext.asp?issn=0973-709x&year=2015&volume=9&issue=10&page= QC01&issn=0973-709x&id=6580 https://doi.org/10.7860/JCDR/2015/13973.6580 PMID: 26557568
- Jha S, Salve HR, Goswami K, Sagar R, Kant S. Burden of common mental disorders among pregnant women: A systematic review. Asian J Psychiatry. 2018 Aug; 36:46–53. <u>https://doi.org/10.1016/j.ajp.</u> 2018.06.020 PMID: 29966886
- 22. Fawcett EJ, Fairbrother N, Cox ML, White IR, Fawcett JM. The Prevalence of Anxiety Disorders During Pregnancy and the Postpartum Period: A Multivariate Bayesian Meta-Analysis. J Clin Psychiatry [Internet]. 2019 Jul 23 [cited 2023 Aug 15]; 80(4). Available from: https://www.psychiatrist.com/JCP/article/Pages/2019/v80/18r12527.aspx https://doi.org/10.4088/JCP.18r12527 PMID: 31347796
- Dadi AF, Miller ER, Bisetegn TA, Mwanri L. Global burden of antenatal depression and its association with adverse birth outcomes: an umbrella review. BMC Public Health. 2020 Dec; 20(1):173. https://doi. org/10.1186/s12889-020-8293-9 PMID: 32019560
- 24. Van den Bergh BRH, van den Heuvel MI, Lahti M, Braeken M, de Rooij SR, Entringer S, et al. Prenatal developmental origins of behavior and mental health: The influence of maternal stress in pregnancy. Vol. 117, Neuroscience and Biobehavioral Reviews. Elsevier Ltd; 2020 Oct. p. 26–64. <u>https://doi.org/10.1016/j.neubiorev.2017.07.003 PMID: 28757456</u>
- Ward RK, Zamorski MA. Benefits and risks of psychiatric medications during pregnancy. Am Fam Physician. 2002 Aug 15; 66(4):629–36. PMID: 12201556
- Yu X, Liu Y, Huang Y, Zeng T. The effect of nonpharmacological interventions on the mental health of high-risk pregnant women: A systematic review. Complement Ther Med. 2022 Mar; 64:102799. <u>https:// doi.org/10.1016/j.ctim.2022.102799</u> PMID: 34995769
- Dimidjian S, Goodman S. Nonpharmacologic Intervention and Prevention Strategies for Depression During Pregnancy and the Postpartum. Clin Obstet Gynecol. 2009 Sep; 52(3):498–515. <u>https://doi.org/ 10.1097/GRF.0b013e3181b52da6 PMID: 19661764</u>
- Moher D, Liberati A, Tetzlaff J, Altman DG, Grp P. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement (Reprinted from Annals of Internal Medicine). Phys Ther. 2009; 89(9):873–80.
- Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: Is blinding necessary? Control Clin Trials. 1996; 17(1):1–12. https://doi.org/10.1016/0197-2456(95)00134-4 PMID: 8721797
- Verhagen AP, De Vet HCW, De Bie RA, Kessels AGH, Boers M, Bouter LM, et al. The Delphi list: A criteria list for quality assessment of randomized clinical trials for conducting systematic reviews developed by Delphi consensus. J Clin Epidemiol. 1998; 51(12):1235–41. https://doi.org/10.1016/s0895-4356(98)00131-0 PMID: 10086815
- Higgins JPT, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. BMJ Online. 2011; 343(7829). https://doi.org/ 10.1136/bmj.d5928 PMID: 22008217
- Beevi Z, Low WY, Hassan J. The Effectiveness of Hypnosis Intervention in Alleviating Postpartum Psychological Symptoms. Am J Clin Hypn. 2019 Apr 1; 61(4):409–25. <u>https://doi.org/10.1080/00029157</u>. 2018.1538870 PMID: 31017553
- Beevi Z, Low WY, Hassan J. The Effectiveness of Hypnosis Intervention for Labor: An Experimental Study. Am J Clin Hypn. 2017 Sep 11; 60(2):172–91. https://doi.org/10.1080/00029157.2017.1280659 PMID: 28891771
- Beevi Z, Low WY, Hassan J. Impact of Hypnosis Intervention in Alleviating Psychological and Physical Symptoms During Pregnancy. Am J Clin Hypn. 2016 Apr 12; 58(4):368–82. https://doi.org/10.1080/ 00029157.2015.1063476 PMID: 27003486
- Novelia S, Sitanggang TW, Lutfiyanti A. The Effect of Yoga Relaxation on Anxiety Levels among Pregnant Women. Nurse Media J Nurs. 2019 Mar 4; 8(2):86.

- Abd Elgwad F, Mourad M, Mahmoud N. Effect of Benson's Relaxation Therapy on Stress and Physiological Parameters among Women with Preeclampsia. Alex Sci Nurs J. 2021 Jul 1; 23(1):63–74.
- Bastani F, Hidarnia A, Kazemnejad A, Vafaei M, Kashanian M. A Randomized Controlled Trial of the Effects of Applied Relaxation Training on Reducing Anxiety and Perceived Stress in Pregnant Women. J Midwifery Womens Health. 2005 Jul 8; 50(4):e36–40. <u>https://doi.org/10.1016/j.jmwh.2004.11.008</u> PMID: 15973255
- Chang MY, Chen CH, Huang KF. Effects of music therapy on psychological health of women during pregnancy. J Clin Nurs. 2008 Oct; 17(19):2580–7. https://doi.org/10.1111/j.1365-2702.2007.02064.x PMID: 18298503
- Satyapriya M, Nagendra HR, Nagarathna R, Padmalatha V. Effect of integrated yoga on stress and heart rate variability in pregnant women. Int J Gynecol Obstet. 2009 Mar; 104(3):218–22. https://doi. org/10.1016/j.ijgo.2008.11.013 PMID: 19110245
- 40. Tragea C, Chrousos GP, Alexopoulos EC, Darviri C. A randomized controlled trial of the effects of a stress management programme during pregnancy. Complement Ther Med. 2014 Apr; 22(2):203–11. https://doi.org/10.1016/j.ctim.2014.01.006 PMID: 24731890
- Chang HC, Yu CH, Chen SY, Chen CH. The effects of music listening on psychosocial stress and maternal–fetal attachment during pregnancy. Complement Ther Med. 2015 Aug; 23(4):509–15. https://doi.org/10.1016/j.ctim.2015.05.002 PMID: 26275644
- Liu YH, Lee CS, Yu CH, Chen CH. Effects of music listening on stress, anxiety, and sleep quality for sleep-disturbed pregnant women. Women Health. 2016 Apr 2; 56(3):296–311. https://doi.org/10.1080/ 03630242.2015.1088116 PMID: 26361642
- Muthukrishnan S. Effect of Mindfulness Meditation on Perceived Stress Scores and Autonomic Function Tests of Pregnant Indian Women. J Clin Diagn Res [Internet]. 2016 [cited 2023 Aug 8]; Available from: http://jcdr.net/article_fulltext.asp?issn=0973-709x&year=2016&volume=10&issue=4&page= CC05&issn=0973-709x&id=7679 https://doi.org/10.7860/JCDR/2016/16463.7679 PMID: 27190795
- 44. Pan WL, Chang CW, Chen SM, Gau ML. Assessing the effectiveness of mindfulness-based programs on mental health during pregnancy and early motherhood—a randomized control trial. BMC Pregnancy Childbirth. 2019 Dec; 19(1):346. https://doi.org/10.1186/s12884-019-2503-4 PMID: 31601170
- 45. Guardino CM, Dunkel Schetter C, Bower JE, Lu MC, Smalley SL. Randomised controlled pilot trial of mindfulness training for stress reduction during pregnancy. Psychol Health. 2014 Mar 4; 29(3):334–49. https://doi.org/10.1080/08870446.2013.852670 PMID: 24180264
- Yang M, Li L, Zhu H, Alexander IM, Liu S, Zhou W, et al. Music Therapy To Relieve Anxiety In Pregnant Women On Bedrest: A Randomized, Controlled Trial. MCN Am J Matern Nurs. 2009 Sep; 34(5):316– 23. https://doi.org/10.1097/01.NMC.0000360425.52228.95 PMID: 19713801
- Urech C, Fink NS, Hoesli I, Wilhelm FH, Bitzer J, Alder J. Effects of relaxation on psychobiological wellbeing during pregnancy: A randomized controlled trial. Psychoneuroendocrinology. 2010 Oct; 35 (9):1348–55. https://doi.org/10.1016/j.psyneuen.2010.03.008 PMID: 20417038
- Newham JJ, Wittkowski A, Hurley J, Aplin JD, Westwood M. EFFECTS OF ANTENATAL YOGA ON MATERNAL ANXIETY AND DEPRESSION: A RANDOMIZED CONTROLLED TRIAL: Research Article: Effects of antenatal yoga RCT on maternal anxiety. Depress Anxiety. 2014 Aug; 31(8):631–40.
- Davis K, Goodman SH, Leiferman J, Taylor M, Dimidjian S. A randomized controlled trial of yoga for pregnant women with symptoms of depression and anxiety. Complement Ther Clin Pract. 2015 Aug; 21 (3):166–72. https://doi.org/10.1016/j.ctcp.2015.06.005 PMID: 26256135
- 50. García González J, Ventura Miranda MI, Requena Mullor M, Parron Carreño T, Alarcón Rodriguez R. Effects of prenatal music stimulation on state/trait anxiety in full-term pregnancy and its influence on childbirth: a randomized controlled trial. J Matern Fetal Neonatal Med. 2018 Apr 18; 31(8):1058–65. https://doi.org/10.1080/14767058.2017.1306511 PMID: 28287005
- Rajeswari S, SanjeevaReddy N. Efficacy of Progressive Muscle Relaxation on Pregnancy Outcome among Anxious Indian Primi Mothers. Iran J Nurs Midwifery Res. 2020; 25(1):23–30. https://doi.org/10. 4103/ijnmr.IJNMR_207_18 PMID: 31956594
- 52. Estrella-Juarez F, Requena-Mullor M, Garcia-Gonzalez J, Lopez-Villen A, Alarcon-Rodriguez R. Effect of Virtual Reality and Music Therapy on the Physiologic Parameters of Pregnant Women and Fetuses and on Anxiety Levels: A Randomized Controlled Trial. J Midwifery Womens Health. 2023 Jan; 68 (1):35–43. https://doi.org/10.1111/jmwh.13413 PMID: 36383473
- Abarghoee SN, Mardani A, Baha R, Aghdam NF, Khajeh M, Eskandari F, et al. Effects of Benson Relaxation Technique and Music Therapy on the Anxiety of Primiparous Women Prior to Cesarean Section: A Randomized Controlled Trial. Minervini G, editor. Anesthesiol Res Pract. 2022 Dec 23; 2022:1– 9. https://doi.org/10.1155/2022/9986587 PMID: 36589598

- 54. Simavli S, Kaygusuz I, Gumus I, Usluogulları B, Yildirim M, Kafali H. Effect of music therapy during vaginal delivery on postpartum pain relief and mental health. J Affect Disord. 2014 Mar; 156:194–9. https:// doi.org/10.1016/j.jad.2013.12.027 PMID: 24411681
- 55. Simavli S, Gumus I, Kaygusuz I, Yildirim M, Usluogullari B, Kafali H. Effect of Music on Labor Pain Relief, Anxiety Level and Postpartum Analgesic Requirement: A Randomized Controlled Clinical Trial. Gynecol Obstet Invest. 2014; 78(4):244–50. https://doi.org/10.1159/000365085 PMID: 25227477
- 56. García González J, Ventura Miranda MI, Manchon García F, Pallarés Ruiz TI, Marin Gascón ML, Requena Mullor M, et al. Effects of prenatal music stimulation on fetal cardiac state, newborn anthropometric measurements and vital signs of pregnant women: A randomized controlled trial. Complement Ther Clin Pract. 2017 May; 27:61–7. https://doi.org/10.1016/j.ctcp.2017.03.004 PMID: 28438283
- Chuntharapat S, Petpichetchian W, Hatthakit U. Yoga during pregnancy: Effects on maternal comfort, labor pain and birth outcomes. Complement Ther Clin Pract. 2008 May; 14(2):105–15. <u>https://doi.org/ 10.1016/j.ctcp.2007.12.007</u> PMID: 18396254
- Bastani F, Hidarnia A, Montgomery KS, Aguilar-Vafaei ME, Kazemnejad A. Does Relaxation Education in Anxious Primigravid Iranian Women Influence Adverse Pregnancy Outcomes?: A Randomized Controlled Trial. J Perinat Neonatal Nurs. 2006 Apr; 20(2):138–46. https://doi.org/10.1097/00005237-200604000-00007 PMID: 16714913
- Ahmadi M, Rahimi F, Rosta F, AlaviMajd H, Valiani M. Effect of Progressive Muscle Relaxation Training on Postpartum Blues in High-risk Pregnant Women. J Holist Nurs Midwifery. 2019 Oct 30;192–9.
- 60. Ghorbannejad S, MehdizadehTourzani Z, Kabir K, Mansoureh Yazdkhasti. The effectiveness of Jacobson's progressive muscle relaxation technique on maternal, fetal and neonatal outcomes in women with non-severe preeclampsia: a randomized clinical trial. Heliyon. 2022 Jun; 8(6):e09709.
- Liu YH, Chang MY, Chen CH. Effects of music therapy on labour pain and anxiety in Taiwanese firsttime mothers. J Clin Nurs. 2010 Apr; 19(7–8):1065–72. <u>https://doi.org/10.1111/j.1365-2702.2009</u>. 03028.x PMID: 20492051
- 62. Zarenejad M, Yazdkhasti M, Rahimzadeh M, Mehdizadeh Tourzani Z, Esmaelzadeh-Saeieh S. The effect of mindfulness-based stress reduction on maternal anxiety and self-efficacy: A randomized controlled trial. Brain Behav [Internet]. 2020 Apr [cited 2023 Aug 11]; 10(4). Available from: https://onlinelibrary.wiley.com/doi/10.1002/brb3.1561 PMID: 32162450
- Bauer I, Hartkopf J, Wikström AK, Schaal NK, Preissl H, Derntl B, et al. Acute relaxation during pregnancy leads to a reduction in maternal electrodermal activity and self-reported stress levels. BMC Pregnancy Childbirth. 2021 Dec; 21(1):628. https://doi.org/10.1186/s12884-021-04099-4 PMID: 34535120
- 64. Legge AW. On the Neural Mechanisms of Music Therapy in Mental Health Care: Literature Review and Clinical Implications. Music Ther Perspect. 2015; 33(2):128–41.
- 65. Dingle GA, Sharman LS, Bauer Z, Beckman E, Broughton M, Bunzli E, et al. How Do Music Activities Affect Health and Well-Being? A Scoping Review of Studies Examining Psychosocial Mechanisms. Front Psychol. 2021 Sep 8; 12:713818. https://doi.org/10.3389/fpsyg.2021.713818 PMID: 34566791
- 66. Music Rebecchini L., mental health, and immunity. Brain Behav Immun—Health. 2021 Dec; 18:100374.
- Toussaint L, Nguyen QA, Roettger C, Dixon K, Offenbächer M, Kohls N, et al. Effectiveness of Progressive Muscle Relaxation, Deep Breathing, and Guided Imagery in Promoting Psychological and Physiological States of Relaxation. Taylor-Piliae R, editor. Evid Based Complement Alternat Med. 2021 Jul 2; 2021:1–8. https://doi.org/10.1155/2021/5924040 PMID: 34306146
- Kato K, Vogt T, Kanosue K. Brain Activity Underlying Muscle Relaxation. Front Physiol. 2019 Dec 3; 10:1457. https://doi.org/10.3389/fphys.2019.01457 PMID: 31849707
- Cahyati A, Herliana L, Februanti S. Progressive Muscle Relaxation (PMR) Enhances Oxygen Saturation in Patients of Coronary Heart Disease. J Phys Conf Ser. 2020 Mar 1; 1477(6):062018.
- Ohmori F, Shimizu S, Kagaya A. Exercise-induced blood flow in relation to muscle relaxation period. Dyn Med. 2007 Dec; 6(1):5. https://doi.org/10.1186/1476-5918-6-5 PMID: 17490481
- Czamanski-Cohen J, Weihs KL. The bodymind model: A platform for studying the mechanisms of change induced by art therapy. Arts Psychother. 2016 Nov; 51:63–71. <u>https://doi.org/10.1016/j.aip.</u> 2016.08.006 PMID: 27777492
- 72. Gordon EM, Chauvin RJ, Van AN, Rajesh A, Nielsen A, Newbold DJ, et al. A somato-cognitive action network alternates with effector regions in motor cortex. Nature. 2023 May 11; 617(7960):351–9. https://doi.org/10.1038/s41586-023-05964-2 PMID: 37076628
- Burnett-Zeigler I, Schuette S, Victorson D, Wisner KL. Mind–Body Approaches to Treating Mental Health Symptoms Among Disadvantaged Populations: A Comprehensive Review. J Altern Complement Med. 2016 Feb; 22(2):115–24. https://doi.org/10.1089/acm.2015.0038 PMID: 26540645

- 74. Daviu N, Bruchas MR, Moghaddam B, Sandi C, Beyeler A. Neurobiological links between stress and anxiety. Neurobiol Stress. 2019 Nov; 11:100191. https://doi.org/10.1016/j.ynstr.2019.100191 PMID: 31467945
- 75. Tafet GE, Nemeroff CB. The Links Between Stress and Depression: Psychoneuroendocrinological, Genetic, and Environmental Interactions. J Neuropsychiatry Clin Neurosci. 2016 Apr; 28(2):77–88. https://doi.org/10.1176/appi.neuropsych.15030053 PMID: 26548654
- 76. Krishnakumar D, Hamblin MR, Lakshmanan S. Meditation and Yoga can Modulate Brain Mechanisms that affect Behavior and Anxiety- A Modern Scientific Perspective. Anc Sci. 2015 Apr 1; 2(1):13. <u>https:// doi.org/10.14259/as.v2i1.171</u> PMID: 26929928
- Hölzel BK, Carmody J, Vangel M, Congleton C, Yerramsetti SM, Gard T, et al. Mindfulness practice leads to increases in regional brain gray matter density. Psychiatry Res Neuroimaging. 2011 Jan; 191 (1):36–43. https://doi.org/10.1016/j.pscychresns.2010.08.006 PMID: 21071182
- Satyanarayana V, Lukose A, Srinivasan K. Maternal mental health in pregnancy and child behavior. Indian J Psychiatry. 2011; 53(4):351. https://doi.org/10.4103/0019-5545.91911 PMID: 22303046
- 79. Chauhan A, Potdar J. Maternal Mental Health During Pregnancy: A Critical Review. Cureus [Internet]. 2022 Oct 25 [cited 2023 Aug 26]; Available from: https://www.cureus.com/articles/108368-maternalmental-health-during-pregnancy-a-critical-review https://doi.org/10.7759/cureus.30656 PMID: 36426343
- Nillni YI, Mehralizade A, Mayer L, Milanovic S. Treatment of depression, anxiety, and trauma-related disorders during the perinatal period: A systematic review. Clin Psychol Rev. 2018; 66:136. https://doi. org/10.1016/j.cpr.2018.06.004 PMID: 29935979
- Dimidjian S, Goodman SH, Felder JN, Gallop R, Brown AP, Beck A. An open trial of mindfulness-based cognitive therapy for the prevention of perinatal depressive relapse/recurrence. Arch Womens Ment Health. 2015; 18(1):85–94. https://doi.org/10.1007/s00737-014-0468-x PMID: 25298253
- Fink NS, Urech C, Cavelti M, Alder J. Relaxation during pregnancy: What are the benefits for mother, fetus, and the newborn? A systematic review of the literature. J Perinat Neonatal Nurs. 2012; 26 (4):296–306. https://doi.org/10.1097/JPN.0b013e31823f565b PMID: 23111717
- Richter J, Bittner A, Petrowski K, Junge-Hoffmeister J, Bergmann S, Joraschky P, et al. Effects of an early intervention on perceived stress and diurnal cortisol in pregnant women with elevated stress, anxiety, and depressive symptomatology. J Psychosom Obstet Gynecol. 2012; 33(4):162–70. https://doi. org/10.3109/0167482X.2012.729111 PMID: 23078196
- Alder J, Urech C, Fink N, Bitzer J, Hoesli I. Response to induced relaxation during pregnancy: Comparison of women with high versus low levels of anxiety. J Clin Psychol Med Settings. 2011; 18(1):13–21. https://doi.org/10.1007/s10880-010-9218-z PMID: 21225321