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Yoga for epilepsy (Review)

Panebianco M, Sridharan K, Ramaratnam S

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[Intervention Review]

Yoga for epilepsy

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ABSTRACT

Background

This is an updated version of the original Cochrane Review published in the Cochrane Library, Issue 5, 2015.

Yoga may induce relaxation and stress reduction, and influence the electroencephalogram and the autonomic nervous system, thereby controlling seizures. Yoga would be an attractive therapeutic option for epilepsy if proved effective.

Objectives

To assess whether people with epilepsy treated with yoga:

(a) have a greater probability of becoming seizure free;

(b) have a significant reduction in the frequency or duration of seizures, or both; and

(c) have a better quality of life.

Search methods

For this update, we searched the Cochrane Epilepsy Group Specialized Register (3 January 2017), the Cochrane Central Register of Controlled Trials (CENTRAL; 2016, Issue 12) in the Cochrane Library (searched 3 January 2017), MEDLINE (Ovid, 1946 to 3 January 2017), SCOPUS (1823 to 3 January 2017), ClinicalTrials.gov (searched 3 January 2017), the World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) (searched 3 January 2017), and also registries of the Yoga Biomedical Trust and the Research Council for Complementary Medicine. In addition, we searched the references of all the identified studies. No language restrictions were imposed.

Selection criteria

The following study designs were eligible for inclusion: randomised controlled trials (RCT) of treatment of epilepsy with yoga. The studies could be double-, single- or unblinded. Eligible participants were adults with uncontrolled epilepsy comparing yoga with no treatment or different behavioural treatments.

Data collection and analysis

Two review authors independently assessed the trials for inclusion and extracted data. The following outcomes were assessed: (a) percentage of people rendered seizure free; (b) seizure frequency and duration; (c) quality of life. Analyses were on an intention-to-treat basis. Odds ratio (OR) with 95% confidence intervals (95% Cls) were estimated for the outcomes.

Main results

We did not identify any new studies for this update, therefore the results are unchanged.

For the previous version of the review, the authors found two unblinded trials in people with refractory epilepsy. In total these two studies included 50 people (18 treated with yoga and 32 to control interventions). Antiepileptic drugs were continued in all the participants. Baseline phase lasted three months in both studies and treatment phase from five weeks to six months in the two trials. Randomisation was by roll of a die in one study and using a computerised randomisation table in the other one but neither study provided details of concealment of allocation and were rated as unclear risk of bias. Overall, the two studies were rated as low risk of bias (all participants were included in the analysis; all expected and pre-expected outcomes were reported; no other sources of bias).

The overall ORs with 95% CI were as follows: (i) seizure free for six months - for yoga versus sham yoga the OR was 14.54 (95% CI 0.67 to 316.69) and for yoga versus 'no treatment' group it was 17.31 (95% CI 0.80 to 373.45); for Acceptance and Commitment Therapy (ACT) versus yoga the OR was 1.00 (95% Cl 0.16 to 6.42); (ii) reduction in seizure frequency - the mean difference between yoga versus sham yoga group was −2.10 (95% CI −3.15 to −1.05) and for yoga versus 'no treatment' group it was −1.10 (95% CI −1.80 to −0.40); (iii) more than 50% reduction in seizure frequency - for yoga versus sham yoga group, OR was 81.00 (95% CI 4.36 to 1504.46) and for the yoga versus 'no treatment' group it was 158.33 (95% CI 5.78 to 4335.63); ACT versus yoga OR was 0.78 (95% Cl 0.04 to 14.75); (iv) more than 50% reduction in seizure duration - for yoga versus sham yoga group OR was 45.00 (95% CI 2.01 to 1006.75) and for yoga versus 'no treatment' group it was 53.57 (95% CI 2.42 to 1187.26); ACT versus yoga OR was 0.67 (95% Cl 0.10 to 4.35).

In addition in Panjwani 1996 the authors reported that the one-way analysis of variance revealed no statistically significant differences between the three groups. A P-Lambda test taking into account the P values between the three groups also indicated that the duration of epilepsy in the three groups was not comparable. No data were available regarding quality of life. In Lundgren 2008 the authors reported that there was no significant difference between the yoga and ACT groups in seizure-free rates, 50% or greater reduction in seizure frequency or seizure duration at one-year follow-up. The yoga group showed significant improvement in their quality of life according to the Satisfaction With Life Scale (SWLS) ($P < 0.05$), while the ACT group had significant improvement in the World Health Organization Quality of Life-BREF (WHOQOL-BREF) scale ($P < 0.01$).

Overall, we assessed the quality of evidence as low; no reliable conclusions can be drawn at present regarding the efficacy of yoga as a treatment for epilepsy.

Authors' conclusions

A study of 50 subjects with epilepsy from two trials reveals a possible beneficial effect in control of seizures. Results of the overall efficacy analysis show that yoga treatment was better when compared with no intervention or interventions other than yoga (postural exercises mimicking yoga). There was no difference between yoga and Acceptance and Commitment Therapy. However no reliable conclusions can be drawn regarding the efficacy of yoga as a treatment for uncontrolled epilepsy, in view of methodological deficiencies such as limited number of studies, limited number of participants randomised to yoga, lack of blinding and limited data on quality-of-life outcome. Physician blinding would normally be taken to be the person delivering the intervention, whereas we think the 'physician' would in fact be the outcome assessor (who could be blinded), so that would be a reduction in detection bias rather than performance bias. In addition, evidence to inform outcomes is limited and of low quality. Further high-quality research is needed to fully evaluate the efficacy of yoga for refractory epilepsy.

Since we did not find any new studies, our conclusions remain unchanged.

PLAIN LANGUAGE SUMMARY

Yoga for epilepsy

Review question

This review assessed the use of yoga as a treatment for control of epilepsy.

Background

Epilepsy is a disorder in which recurrent seizures are caused by abnormal electrical discharges in the brain. Most seizures can be controlled by antiepileptic drugs (AEDs) but sometimes seizures develop which are resistant to those drugs. People may also wish to try non-drug treatments such as yoga. Between 25% and 40% of people with epilepsy treated with AEDs have uncontrolled seizures, experience adverse effects from medication, suffer from stigmatisation and have a higher degree of psychiatric disorders as compared with people with other chronic illnesses. For those who have epilepsy and related problems it is important to develop, evaluate, and implement a complementary treatment model in the everyday treatment of epilepsy.

Yoga, an integral part of Indian culture and heritage, is said to bestow good health - physical, mental and spiritual - on the practitioner. There are various types of yoga involving postural exercises (asanas), breath control (pranayama) and meditation. In one study, the practice of Sahaja yoga, a simple form of meditation, reduced seizures and EEG changes in people with epilepsy. The effect of meditation was attributed to a reduction in the level of stress as evidenced by changes in skin resistance and levels of blood lactate and urinary vanillylmandelic acid.

Results

For this update, we did not identify any new studies to add, and thus the conclusions remain unchanged. The review included two unblinded randomised controlled trials (RCTs) recruiting a total of 50 participants (adults) with refractory epilepsy and comparing any type of classical Indian yoga to the control groups receiving no intervention or interventions such as yoga-mimicking exercises or Acceptance and Commitment Therapy. Antiepileptic drugs were continued in all the participants. The outcomes assessed were: percentage of people rendered seizure free; seizure frequency and duration; and quality of life. Results of the overall efficacy analysis show that yoga treatment was better when compared with no intervention or interventions other than yoga, but no reliable conclusions can be drawn regarding the efficacy of yoga as a treatment for uncontrolled epilepsy. The yoga group showed significant improvement in their quality of life according to the Satisfaction With Life Scale. Blinding may reduce the observer bias. Physician blinding may be achieved with the outcomes being assessed by a physician who is not involved in the trial. Participant blinding may not be possible, since it would be easy to distinguish whether the intervention given is yoga or not. It would be ideal if the seizure records are maintained by a blinded observer. Seizure frequency outcomes should preferably be expressed as the proportion of individuals seizure free or proportion with more than 50% reduction in seizure frequency, since mean values of seizure frequency are often skewed and difficult to analyse. Seizure duration may be measured in seconds or minutes (per episode or month). Validated quality-of-life measures (disease specific) may indicate whether there is overall improvement in the quality of life as a result of the intervention, besides seizure control.

Conclusions

No reliable conclusions can be drawn at present regarding the efficacy of yoga as a treatment for epilepsy. In addition, quality of the evidence to inform outcomes is limited and of low quality. Yoga can be considered as a complex intervention, similar to other forms of complementary and alternative treatments. Yoga can only be an add-on to AEDs at the present time and cannot be used as the sole method of intervention. Finally, no reliable evidence was found to support the use of yoga and further trials are needed.

The evidence is current to 3 January 2017.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Yoga versus no yoga for uncontrolled epilepsy

Patient or population: people with epilepsy
Settings: outpatients
Intervention: yoga
Comparison: no yoga

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	No yoga (control)	Yoga				
Seizure free (yoga versus sham yoga)[2]	0 per 1000	400 per 1000	OR 14.54 (0.67 to 316.69)	20 (1 study)	⊕⊕◯◯ low[3,4]	OR > 1 indicates outcome is more likely on Yoga
Seizure free (yoga versus none)[2]	0 per 1000	400 per 1000	OR 17.31 (0.8 to 373.45)	22 (1 study)	⊕⊕◯◯ low[3,4]	OR > 1 indicates outcome is more likely on Yoga
Seizure frequency (yoga versus sham yoga)	The mean seizure frequency was 2.6 seizures per month (SD 1.58)	The mean seizure frequency was −2.10 seizures per month lower (95% CI −3.15 to −1.05)	NA	20 (1 study)	⊕⊕◯◯ low[3,4]	
Seizure frequency (yoga versus none)	The mean seizure frequency was 1.6 seizures per month (SD 1.03)	The mean seizure frequency was −1.10 seizures per month lower (95% CI −1.80 to −0.40)	NA	22 (1 study)	⊕⊕◯◯ low[3,4]	

Greater than 50% reduction in seizure frequency (yoga versus sham yoga)	100 per 1000	800 per 1000 (226 to 894 per 1000)	OR 81 (4.36 to 1504.46)	20 (1 study)	⊕⊕◯◯ low[3,4]	OR > 1 indicates outcome is more likely on Yoga
Greater than 50% reduction in seizure frequency (yoga versus none)[2]	0 per 1000	900 per 1000	OR 158.33 (5.78 to 4335.63)	22 (1 study)	⊕⊕◯◯ low[3,4]	OR>1 indicates outcome is more likely on Yoga
Greater than 50% reduction in seizure duration (yoga versus sham yoga)[2]	0 per 1000	700 per 1000	OR 45.00 (2.01 to 1006.75)	20 (1 study)	⊕⊕◯◯ low[3,4]	OR > 1 indicates outcome is more likely on Yoga
Greater than 50% reduction in seizure duration (yoga versus sham yoga)[2]	0 per 1000	700 per 1000	OR 53.57 (2.42 to 1187.26)	22 (1 study)	⊕⊕◯◯ low[3,4]	OR > 1 indicates outcome is more likely on Yoga

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes[1]. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: confidence interval; **OR:** odds ratio.

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]Assumed risk is calculated as the event rate in the control group per 1000 people (number of events divided by the number of participants receiving control treatment).
[2]Assumed risk could not be calculated as no events occurred in the control group; therefore corresponding risk is estimated as event rate in the intervention group per 1000 people.
[3] In the study no blinding was achieved and it was rated as high risk of bias.
[4] The study has wide confidence intervals and, as a result, a wide confidence interval of the pooled effect estimate, suggesting imprecision.

BACKGROUND

This review is an update of a previously published review in the *Cochrane Database of Systematic Reviews* (Issue 5, 2015).

Description of the condition

Epilepsy is a condition characterised by a tendency for recurrent seizures unprovoked by any known proximate insult. Epileptiform discharges involve either a localised area of the brain resulting in a partial seizure; or the entire brain resulting in a generalised seizure. The prevalence of epilepsy is estimated to be five to eight per 1000 population in developed countries, and in adults the most common type is partial epilepsy (Forsgren 2005). The majority of people given a diagnosis of epilepsy have a good prognosis, and their seizures will be controlled by treatment with a single antiepileptic drug (AED), but up to 30% do not have remission despite appropriate therapy with AEDs (Kwan 2000). These people tend to have frequent, disabling seizures that limit their ability to work and participate in activities. Many of these people also suffer from the chronic effects of long-term, high-dose AED polytherapy. People who have seizures more frequently have psychiatric disorders like anxiety, depression and low quality of life as compared with those with other chronic illness. The stigmatisation problems associated with epilepsy are well documented and can be linked to a number of factors, including under-resourced medical seizures, poor seizure control and inadequate knowledge of epilepsy (Jacoby 2002). The development of effective therapies for the treatment of uncontrolled epilepsy is therefore of considerable importance.

Description of the intervention

Yoga is a traditional Indian discipline and way of life which gives the practitioner a "healthy body and a sound mind" and is believed to alleviate stress and induce relaxation (Anand 1991). The word 'yoga' is probably derived from the Sanskrit word 'Yug' which means 'controlling the mind'. The commonly performed yogic practices include breathing exercises (pranayama), postures (asanas), devotional sessions and meditation (dhyana). Many branches of yoga have been described such as Hatha yoga, Karma yoga, Bhakti yoga and Raja yoga. Transcendental Meditation, which is widely practised, employs a single-stage meditation during which the individual sits quietly with eyes closed for 20 minutes twice a day and mentally repeats a specifically chosen Sanskrit word or mantra (Corby 1978). In Sahaja yoga, the practitioners sit in a relaxed posture with hands in front, palms upwards. They are asked to direct attention to a picture placed in front of them, with a candle lit before it. Gradually when their thoughts recede, they close their eyes and may direct their attention at the 'sahasrara chakra' or top of the head. The individual sits in meditation for about 10 to 15 minutes. It is believed that Sahaja yoga awakens the kundalini (dormant divine energy in our body) and corrects physical, mental and emotional disorders (Gupta 1991). Sahaja yoga is a simple technique of meditation which is practised easily by any individual, without the use of instruments. It has been found beneficial for stress reduction in people with epilepsy (Panjwani 1995).

How the intervention might work

Behavioural methods are currently being tried for seizure reduction since some people with epilepsy do not achieve seizure control despite regular and adequate medication. Research suggesting that behavioural treatments can influence the seizure process is substantial (Lundgren 2006; Ramaratnam 2001). Yoga may induce relaxation and stress reduction, and influence the electroencephalogram and the autonomic nervous system, thereby controlling seizures. There are several reports regarding the use of yoga in psychiatric disorders (Miller 1995; Nespoor 1993; Nespoor 1994), mental retardation (Uma 1989), asthma (Goyeche 1980; Goyeche 1982; Jain 1993a; Nagaratna 1985; Nagendra 1986; Singh 1990), rehabilitation of myocardial infarct patients (Bulavin 1993), arthritis (Garfinkel 1994; Haslock 1994), hypertension (Patel 1975; Sundar 1984; Van Montfrans 1990), and other medical disorders (Jain 1993b). The effect of yoga on the electroencephalogram (Banquet 1973; Corby 1978; Dostalek 1979; Gastaut 1975; Kugler 1982; Lerner 1975; Orme-Johnson 1988; Roldan 1983; Roldan 1985; Satyanarayana 1992; Stancak 1991; Stancak 1994; Surwillo 1978; Xu 1994; Zhang 1988) and on the autonomic nervous system (Bhargava 1988; Telles 1993; Telles 1994; Telles 1995) have also been studied. Yoga has been demonstrated to increase quality of life and decrease psychiatric problems for those who have epilepsy (Yardi 2001). Stress is a well-recognised risk factor for seizures in people with epilepsy (Temkin 1984); and the efficacy of yoga in stress reduction has been documented (Panjwani 1995; Schell 1994). There are also reports on the efficacy of biofeedback, relaxation and behaviour modification in the treatment of epilepsy (Cabral 1976; Dahl 1985; Dahl 1987; Dahl 1988; Puskarich 1992). Persinger 1993, based on a personal philosophy interview of 221 university students practising meditation, hypothesised that Transcendental Meditation and general meditation (cognitive kindling) trigger "complex partial epileptic-like signs" such as experience of vibrations, hearing one's name called, paranormal phenomena, etc. However, this view has been strongly opposed by Orme-Johnson 1995 based on other studies not quoted by Persinger. Yoga may have an effect on the probability of seizure occurrence because of the effect it has on brain wave activity and arousal level. Research shows that sudden changes in cortical activity and arousal level affect the probability of seizure occurrence. Other authors suggest that yoga training stimulates the vagus nerve, and stimulation of the vagus nerve has been shown to decrease seizure frequency by 28% to 38% (Brown 2005).

Why it is important to do this review

For this review we summarise evidence from randomised controlled trials where the efficacy of yoga has been investigated for people with uncontrolled epilepsy. The aim was to evaluate the effects of yoga on seizure frequency and on quality of life. Yoga would be an attractive therapeutic option for epilepsy (if proven effective) in view of its non-pharmacological nature, minimal adverse effects and international acceptance.

OBJECTIVES

To assess whether people with epilepsy treated with yoga:

(a) have a greater probability of becoming seizure free;

(b) have a significant reduction in the frequency or duration of seizures, or both; and

(c) have a better quality of life.

METHODS

Criteria for considering studies for this review

Types of studies

In this review trials had to meet the following criteria.

1. Randomised controlled trials.
2. Parallel group or crossover studies.
3. Cluster or individual randomisation.

Types of participants

Eligible participants were people with all types of epilepsy, of all age groups, and both genders.
Epileptic control group included people with all types of epilepsy, of all age groups, and both genders, with no treatment or other behavioural treatment.

Types of interventions

Any type of classical Indian yoga compared to the control group receiving no intervention or interventions other than yoga, e.g. muscle relaxation training or sham yoga or postural yoga-mimicking exercises or Acceptance and Commitment Therapy (ACT). The use of antiepileptic drugs was permitted in both the treatment and the control groups.

Types of outcome measures

The following outcome measures from the time of randomisation to the completion of the study were analysed.

Primary outcomes

Seizure frequency

1. Number of individuals seizure free.
2. Number of seizures per month (mean per participant or per group).
3. Number of individuals with more than 50% reduction in seizure frequency.
4. Percentage change in seizure frequency.

Seizure duration

1. Seizure duration (minutes or seconds, per participant or per group).
2. Number of individuals with more than 50% reduction in seizure duration.
3. Percentage change in seizure duration.

Secondary outcomes

1. Improvement in the quality of life (if assessed by standardised, reliable and valid instruments).
2. Dropout rates due to noncompliance or other reasons.
3. Reduction in dosage of anticonvulsants (yes or no).

Search methods for identification of studies

Electronic searches

For the previous version of the review, the authors searched the following databases for relevant studies (Panebianco 2015).
(a) The Cochrane Epilepsy Group Specialized Register (searched 26 March 2015) using the search terms "yoga or relaxation or meditation or pranayama or asanas";
(b) Cochrane Central Register of Controlled Trials (CENTRAL; 2015, Issue 2) in the Cochrane Library (searched 26 March 2015).
(c) MEDLINE Ovid (1946 to 26 March 2015).
(d) SCOPUS (searched 9 January 2014).
(e) US National Institutes of Health Ongoing Trials Register (ClinicalTrials.gov; searched 26 March 2015).
(f) The World Health Organization (WHO) International Clinical Trials Registry Platform ICTRP (apps.who.int/trialsearch; searched 26 March 2015).
(g) The registries of the Yoga Biomedical Trust, and Research Council for Complementary Medicine.

SCOPUS was searched as a substitute for Embase, but this is no longer necessary, because randomised or quasirandomised controlled trials in Embase are now included in CENTRAL. SCOPUS was therefore not included in the pre-publication search carried out on 26 March 2015.

For this update, we searched the following databases for relevant studies.

(a) The Cochrane Epilepsy Group Specialized Register (searched 3 January 2017) using the search terms "yoga or relaxation or meditation or pranayama or asanas", using the strategy outlined Appendix 1.

(b) Cochrane Central Register of Controlled Trials (CENTRAL; 2016, Issue 12) in the Cochrane Library (searched 3 January 2017), using the strategy outlined in Appendix 2.

(c) MEDLINE Ovid (1946 to 3 January 2017), using the strategy outlined in Appendix 3.

(d) US National Institutes of Health Ongoing Trials Register (www.clinicaltrials.gov; searched 3 January 2017), using the strategy outlined in Appendix 4.

(e) The World Health Organization (WHO) International Clinical Trials Registry Platform ICTRP (apps.who.int/trialsearch; searched 03 January 2017), using the strategy outlined in Appendix 5.

(f) The registries of the Yoga Biomedical Trust, and Research Council for Complementary Medicine.

SCOPUS was searched as a substitute for Embase, but this is no longer necessary, because randomised or quasirandomised controlled trials in Embase are now included in CENTRAL. SCOPUS was therefore not included in the pre-publication search carried out on 3 January 2017.

We imposed no language restrictions. We tailored searches to individual databases, and adapted from those used in the previous review.

Searching other resources

For the previous review and this update, we reviewed reference lists of included studies to search for additional reports of relevant studies. We also contacted the members of the Neurological Society of India through the newsletter of the Society to seek any completed (unpublished or published) or ongoing studies. Letters or e-mails were sent to several neurophysiology institutions, yoga institutes and yoga experts in India as well as outside India, to find out any studies (unpublished or published in non-indexed journals) regarding the treatment of epilepsy with yoga. The abstracts were independently perused by two review authors (SR and KS), to assess their relevance for inclusion in the review. Cross-references were obtained from the relevant identified articles.

Data collection and analysis

Selection of studies

For this update, two review authors (MP and SR) independently assessed trials for inclusion. We resolved any disagreements by discussion with a third author (KS). Two review authors (MP and SR) independently extracted data and assessed the risk of bias for included trials; again disagreements were resolved by discussion.

Data extraction and management

We extracted the following data for each trial using a data extraction form.

(I) Methodological/trial design

1. Method of randomisation.
2. Method of allocation concealment.
3. Method of double blinding.
4. Whether any participants had been excluded from reported analyses.
5. Duration of baseline period.
6. Duration of treatment period.
7. Duration of follow-up.
8. Information on sponsorship/funding.

(II) Participant/demographic information

1. Number of participants allocated to each treatment group (total per group).
2. Age and gender distribution.
3. Type of epilepsy.
4. Duration of epilepsy.
5. Aetiology of epilepsy.
6. Type of intervention.

(III) Outcomes

We recorded the number of participants experiencing each outcome per randomised group (see Types of outcome measures). We contacted authors of trials for any missing information.

Assessment of risk of bias in included studies

Two review authors (MP and SR) independently assessed the risk of bias for each trial using the Cochrane 'Risk of bias' tool as described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We discussed and resolved disagreements. We completed a 'Risk of bias' table for each included study in Review Manager 5 (RevMan 5). Included studies were rated as low, high or unclear risk of bias on six domains applicable to randomised controlled trials: randomisation method, allocation concealment, blinding methods, incomplete outcome data, selective outcome reporting, and other sources of bias. We created 'Summary of findings' tables using GRADEpro and the GRADE approach for assessing the quality of evidence (Schünemann 2013).

Measures of treatment effect

The primary outcomes of seizure frequency and seizure duration were analysed as a binary outcome and presented as odds ratios

(ORs). Mantel-Haenszel ORs and 95% confidence intervals (CIs) are estimators for categorical data such as the proportion of individuals seizure free or 50% responders, while the mean difference (MD) and 95% CI may be used for continuous data such as mean seizure frequency. We planned to analyse the secondary outcomes, including quality of life, treatment withdrawal and reduction in antiepileptic drug (AED), as continuous outcomes and present them using the standardised mean difference. However, this was not possible (different definitions of outcomes were employed so data could not be pooled) and therefore we have discussed these outcomes narratively.

Unit of analysis issues

We encountered no unit of analysis issues as we found no crossover studies. All studies were randomised at an individual level so we included no cluster randomised studies and data were not of a longitudinal design. We analysed all outcomes as ORs as planned, or discussed narratively.

Dealing with missing data

We sought any missing data from the study authors. We present all analyses in the main report.

Assessment of heterogeneity

Clinical heterogeneity was not applicable, because we were unable to pool findings from studies. Clinical heterogeneity should be assessed by comparing the distribution of important individual participant factors among trials (for example age, seizure type, duration of epilepsy, number of AEDs taken at the time of randomisation) and trial factors (for example randomisation concealment, blinding, losses to follow-up).

Assessment of reporting biases

We requested all protocols from study authors to enable a comparison of outcomes of interest. If we had suspected outcome reporting bias for any included study, we planned to further investigate using the ORBIT matrix system (Kirkham 2010). We planned to examine funnel plot asymmetry to establish publication bias; however such an assessment was not possible due to the small number of studies included in the review.

Data synthesis

We employed a fixed-effect model meta-analysis to synthesise the data. Comparisons we expected to carry out included:

1. intervention group (yoga) versus controls on seizure free;
2. intervention group (yoga) versus controls on seizure frequency;
3. intervention group (yoga) versus controls on greater than 50% reduction in seizure frequency;
4. intervention group (yoga) versus controls on greater than 50% reduction in seizure duration.

We stratified each comparison by type of control group and study characteristics to ensure the appropriate combination of study data. We calculated ORs with 95% Cl for the categorical data; and MD with 95% CI for continuous data.

Subgroup analysis and investigation of heterogeneity

We planned to undertake subgroup analysis for study, participant characteristics, outcomes, etc. We intended to investigate heterogeneity using sensitivity analysis if we deemed it appropriate.

Sensitivity analysis

We also intended to carry out sensitivity analysis if we found peculiarities between study quality, participants' characteristics, interventions and outcomes.

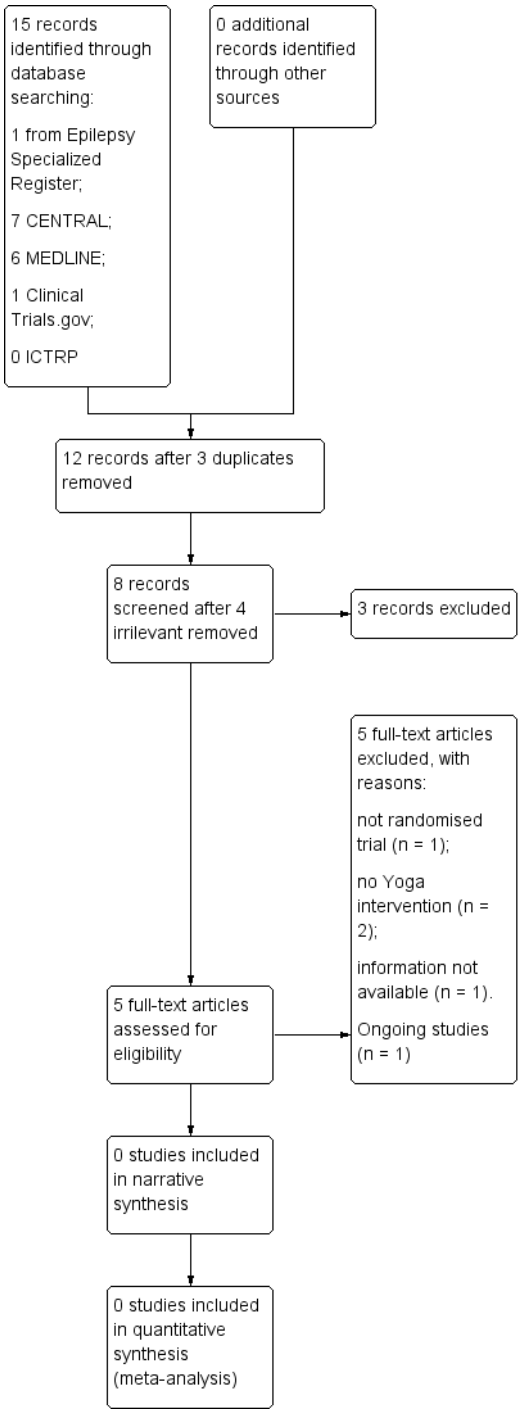
RESULTS

Description of studies

Results of the search

The latest search (carried out 3 January 2017) identified 15 records from the databases outlined above. We screened 8 records for inclusion in the review after removing duplicates and irrelevant items. We excluded 3 records at this point, and requested five full-text articles to assess for eligibility. We contacted authors of these trials for more information providing their contact details were available. Following this, we excluded 4 studies (please see Figure 1 and Characteristics of excluded studies for reasons of exclusion). We identified one study as ongoing (see Characteristics of ongoing studies). Thus, no new studies were included in this review.

Figure 1. Study flow diagram



Included studies

We did not find any new studies for this update. In the previous version of this review, the authors included two randomised controlled trials which recruited a total of 50 participants with uncontrolled epilepsy (Lundgren 2008; Panjwani 1996). Trial characteristics are summarised below; for further information on each trial please see Characteristics of included studies.

One single centre trial investigated 18 subjects aged 18 to 55 years with uncontrolled epilepsy, and had two treatment arms: Acceptance and Commitment therapy (ACT); and yoga (Lundgren 2008). Antiepileptic drugs (AEDs) were continued in both groups. This trial had a baseline period of three months and a treatment period of five weeks. Dahl 2005 is linked to this study.

Another single centre trial randomised 32 subjects aged 15 to 35 years with drug-resistant epilepsy to one of three treatment arms: Sahaja yoga (group I); exercises mimicking Sahaja yoga (group II); and control group without any intervention (group III) (Panjwani 1996). AEDs were continued in all three groups. This trial had a baseline period of three months and a treatment period of six months. The mean age, mean duration of epilepsy and the baseline seizure frequencies at the time of recruitment to the study were lower in group III ('no treatment' control) compared to groups I (Sahaja yoga) and II (sham yoga). We contacted the author of this study for additional data not available in the publication, i.e. details of the randomisation procedure, and details of outcome measures not included in the publication (including the number of individuals with more than a 50% reduction in seizure frequency and number of individuals with more than a 50% reduction in seizure duration in each group). The author provided some additional data regarding this study. Panjwani 2000 is linked to this study.

Excluded studies

In this update, we excluded 4 studies for the following reasons: one study was not randomised; two studies did not use yoga as an intervention; one study provided insufficient information. For further information on each trial please see Characteristics of excluded studies.

Risk of bias in included studies

See Figure 2 and Figure 3 for a summary of the risk of bias in each included study. Each study was allocated an overall rating for risk of bias. All studies included in the review were individually rated as low risk of bias or high risk of bias or unclear risk of bias. See below for specific domain ratings.

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

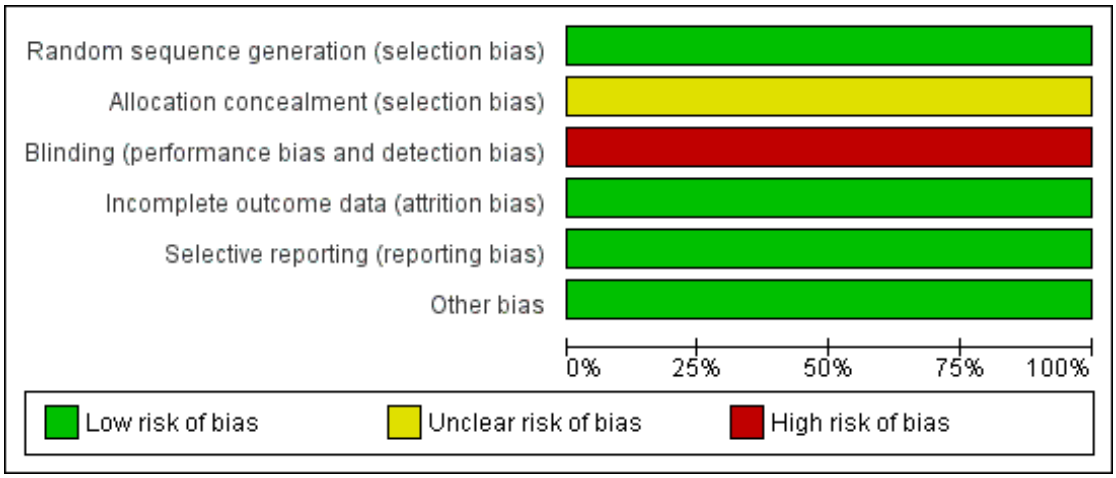
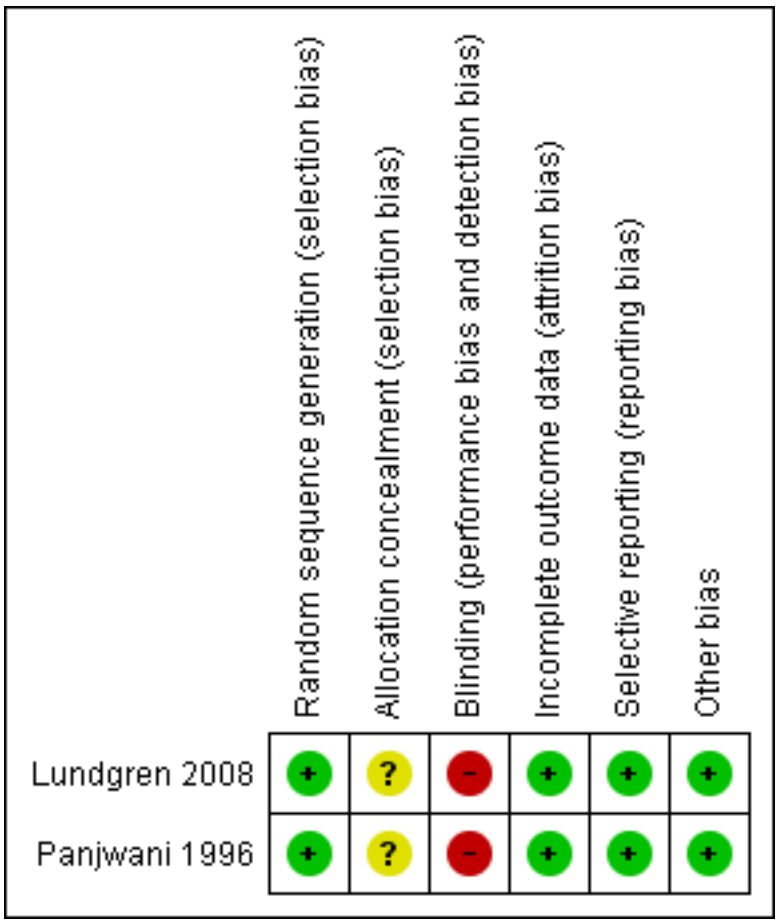


Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



Allocation

In both Lundgren 2008 and Panjwani 1996, the methods by which allocation was concealed was rated as unclear risk of bias. The two trials did not provide details of concealment of allocation. As for the domain of sequence generation, both studies were rated as low risk of bias (Lundgren 2008; Panjwani 1996). In the Lundgren 2008 study randomisation was generated using a computerised randomisation table. The randomisation procedure in the Panjwani 1996 trial was by rolling dice.

Blinding

In both studies included, no blinding was achieved by using yoga treatment and they were rated as high risk of bias on this particular domain (Lundgren 2008; Panjwani 1996). This could limit the validity of the observed treatment effects.

Incomplete outcome data

Both studies were rated as low risk of bias because all participants were included in the analysis (Lundgren 2008; Panjwani 1996).

Selective reporting

In both studies selective reporting was rated as low risk of bias due to all expected and pre-specified outcomes being reported in each of the publications (Lundgren 2008; Panjwani 1996). The protocols were not available when requested to compare a priori methods and outcomes to the published report.

Other potential sources of bias

Both studies appeared to be free of other sources of bias and were therefore rated as low risk of bias on this domain.

Effects of interventions

See: **Summary of findings for the main comparison**; **Summary of findings 2**

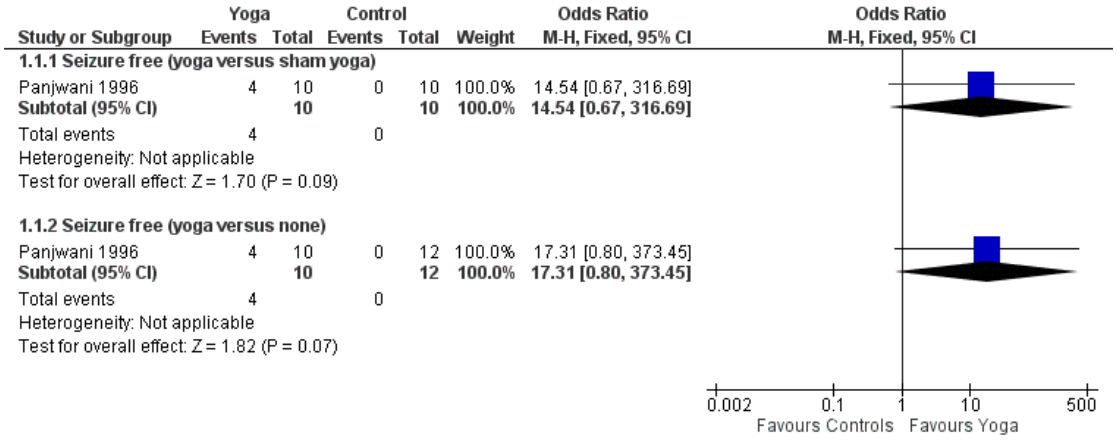
See: Summary of findings for the main comparison, Summary of findings 2.

(a) Seizure frequency

1. Number of participants seizure free

In the Panjwani 1996 study, 4 out of the 10 participants given Sahaja yoga were seizure free for the duration of the six months' treatment period, compared to none out of 10 in the sham yoga group and none out of 12 in the 'no treatment' control group. This gives odds ratios (ORs) with 95% confidence intervals (Cls) of 14.54 (95% CI 0.67 to 316.69) for the yoga versus sham yoga groups; and 17.31 (95% CI 0.80 to 373.45) for yoga versus 'no treatment' control groups (see Analysis 1.1; Figure 4).

Figure 4. Forest plot of comparison: 1 Yoga versus no yoga, outcome: 1.1 Seizures six months after treatment.



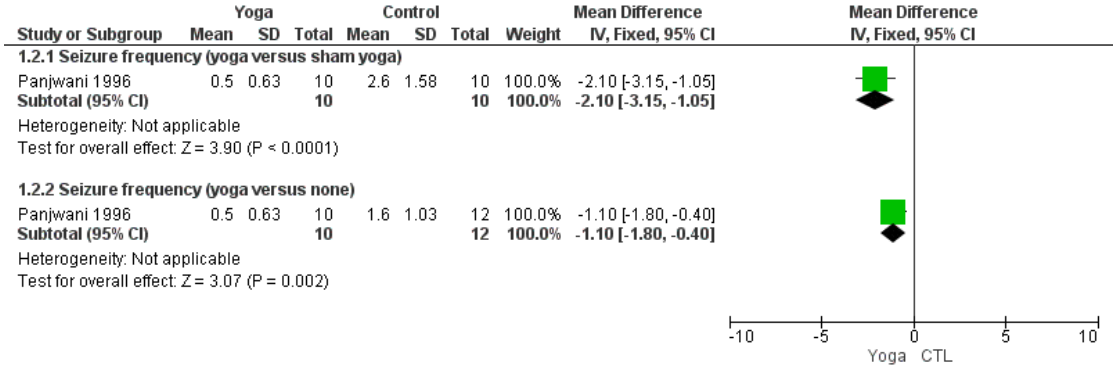
In the Lundgren 2008 study, comparing Acceptance and Commitment Therapy (ACT) versus yoga, 5 of the 10 participants in the ACT group and 4 of the 8 participants in the yoga group were seizure free at the end of the trial (12-month follow-up). This gives ORs with 95% CIs of 1.00 (95% CI 0.16 to 6.42) for yoga versus ACT (see Analysis 2.1; Figure 5).

Figure 5. Forest plot of comparison: 2 Yoga versus Acceptance Commitment Therapy (ACT), outcome: 2.1 Seizure free at 1 year follow-up.

2. Reduction in seizure frequency

In the Panjwani 1996 trial the number of seizures per month in the three different groups are shown in Table 1. Control group III (no treatment) has differing baseline seizure frequency compared to groups I and II which is statistically significant (group I versus group III t = 2.25, P = 0.043). The mean difference (95% CIs in seizure frequency after six months) for group I (Sahaja yoga) versus group II (sham yoga) was −2.10 (95% CI −3.15 to −1.05) and for group I versus group III −1.10 (95% CI −1.80 to −0.40). The reduction in seizure frequency in group I was found to be statistically significant (P < 0.001) compared to the baseline frequency (0 month) (see Analysis 1.2; Figure 6).

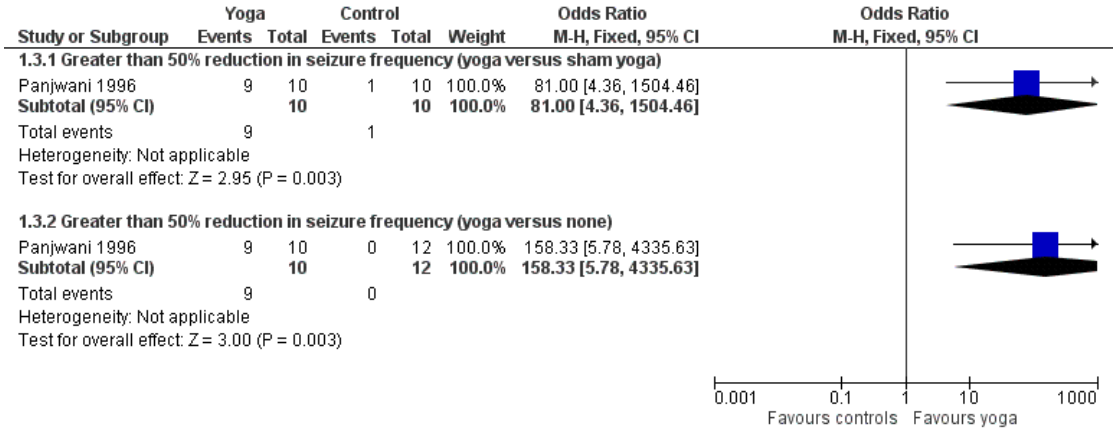
Figure 6. Forest plot of comparison: 1 Yoga versus no yoga, outcome: 1.2 Seizure frequency (number per month).



3. More than 50% reduction in seizure frequency

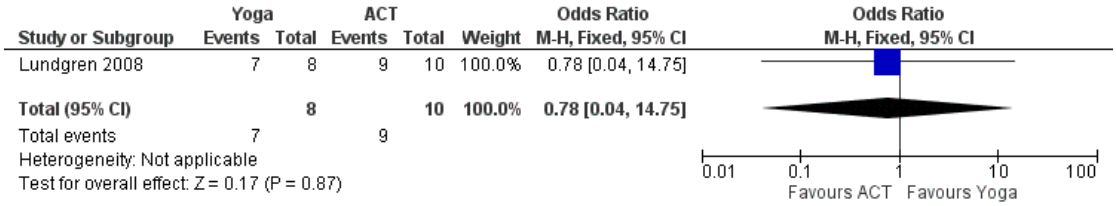
In the Panjwani 1996 study more than 50% reduction in seizure frequency was found in 9 out of the 10 participants practising Sahaja yoga but only in 1 out of the 10 on sham yoga and none of the 12 untreated controls. This gives ORs of 81.00 (95% CI 4.36 to 1504.46) and 158.33 (95% CI 5.78 to 4335.63) respectively (see Analysis 1.3; Figure 7).

Figure 7. Forest plot of comparison: 1 Yoga versus no yoga, outcome: 1.3 Greater than 50% reduction in seizure frequency - six months.



Lundgren 2008, comparing ACT versus yoga, found 50% or greater reduction in seizure frequency in 9 of 10 participants in the ACT group and 7 of 8 participants in the yoga group. This gives ORs of 0.78 (95% Cl 0.04 to 14.75) for yoga versus ACT (see Analysis 2.2; Figure 8).

Figure 8. Forest plot of comparison: 2 Yoga versus Acceptance Commitment Therapy (ACT), outcome: 2.2 50% or greater reduction in seizure frequency.

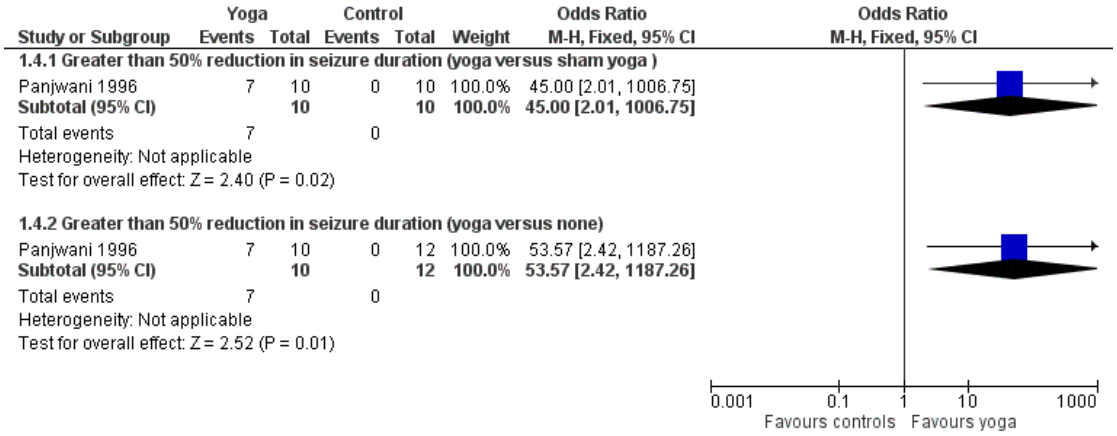


(b) Seizure duration

1. Greater than 50% reduction in seizure duration after six months

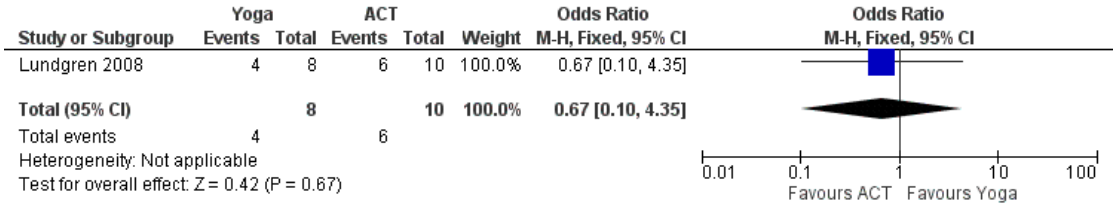
In Panjwani 1996, seven participants given Sahaja yoga had more than 50% reduction in seizure duration compared to none among the two control groups. This gives ORs of 45.00 (95% CI 2.01 to 1006.75) for group I versus group II; and 53.57 (95% CI 2.42 to 1187.26) for group I versus group III respectively (see Analysis 1.4; Figure 9).

Figure 9. Forest plot of comparison: 1 Yoga versus no yoga, outcome: 1.4 Greater than 50% reduction in seizure duration - six months.



In the Lundgren 2008 trial 6 of 10 participants in the ACT group and 4 of 8 in the yoga group had 50% or greater reduction in seizure duration at the end of one year. This gives ORs of 0.67 (95% Cl 0.10 to 4.35) for yoga versus ACT (see Analysis 2.3; Figure 10).

Figure 10. Forest plot of comparison: 2 Yoga versus Acceptance Commitment Therapy (ACT), outcome: 2.3 50% or greater reduction in seizure duration.



(c) Quality of Life (pretest to post-test)

In Lundgren 2008 the World Health Organization Quality of Life-BREF (WHOQOL-BREF) revealed significant improvement among the participants in the ACT group ($P < 0.01$), but the changes on Satisfaction With Life Scale (SWLS) over time were not significant. The participants in the yoga group had significant improvement in their quality of life according to the SWLS ($P < 0.05$), but did not show any significant changes in the WHO-QOL-BREF.

No data were available in the Panjwani 1996 study regarding this outcome. The author concludes that a changed lifestyle with reduction in stress may be an important factor contributing to seizure reduction and EEG changes following Sahaja yoga.

(d) Dropout rates due to noncompliance or other reasons

Included studies did not report this outcome.

(e) Reduction in dosage of AED

Included studies did not report this outcome.

ADDITIONAL SUMMARY OF FINDINGS [Explanation]

Yoga versus Acceptance and Commitment Therapy (ACT) for uncontrolled epilepsy

Patient or population: people with epilepsy
Settings: outpatients
Intervention: yoga
Comparison: Acceptance and Commitment Therapy (ACT)

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No. of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	ACT	Yoga				
Seizure free at 1 year follow-up	500 per 1000	500 per 1000 (138 to 865 per 1000)	OR 1.00 (0.16 to 6.42)	18 (1 study)	⊕⊕◯◯ low[1,2]	OR > 1 indicates outcome is more likely on yoga
50% or greater reduction in seizure frequency	900 per 1000	702 per 1000 (265 to 993 per 1000)	OR 0.78 (0.04 to 14.75)	18 (1 study)	⊕⊕◯◯ low[1,2]	OR > 1 indicates outcome is more likely on yoga
50% or greater reduction in seizure duration	600 per 1000	402 per 1000 (130 to 867 per 1000)	OR 0.67 (0.10 to 4.35)	18 (1 study)	⊕⊕◯◯ low[1,2]	OR > 1 indicates outcome is more likely on yoga

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes.[3] The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
ACT: Acceptance and Commitment Therapy; **CI:** confidence interval; **OR:** odds ratio.

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] In the study no blinding was achieved and it was rated as high risk of bias.
[2] The study has wide confidence intervals and, as a result, a wide confidence interval of the pooled effect estimate, suggesting imprecision.
[3] Assumed risk is calculated as the event rate in the control group per 1000 people (number of events divided by the number of participants receiving control treatment).

DISCUSSION

Summary of main results

Since publication of the previous version of this review, we found no new studies that met the selection criteria for this review.

In the previous review, only two studies met the selection criteria. We were not able to combine the results of the two studies, since the comparison arms were different. In these randomised controlled trials the number of individuals treated was small. These methodological flaws make the results very difficult to interpret. In the Panjwani 1996 study the authors reported that the one-way analysis of variance revealed no statistically significant differences between the three groups. However, by a modified t-test the differences were found to be statistically significant between group I and group III, both for seizure duration (t = 2.457, P = 0.023) and seizure frequency (t = 2.247, P = 0.043). A P-Lambda test taking into account the P values between the three groups also indicated that the duration of epilepsy in the three groups was not comparable. No data were available regarding quality of life. In Lundgren 2008 the authors reported that there was no significant difference between the yoga and ACT groups in seizure-free rates: 50% or greater reduction in seizure frequency or seizure duration at one year follow-up. The yoga group showed significant improvement in their quality of life according to the Satisfaction With Life Scale (SWLS) (P < 0.05), while the Acceptance and Commitment Therapy (ACT) group had significant improvement in the World Health Organization Quality of Life-BREF (WHOQOL-BREF) scale (P < 0.01).

Overall completeness and applicability of evidence

Only two studies look at yoga for epilepsy with 50 participants in total. The participants would be those whose seizures are not controlled with AEDs alone or those who require high doses of AEDs with attendant side effects. Individuals who are not suitable for epilepsy surgery and those who refuse further attempts to find a successful medical therapy may also be candidates for a trial of yoga. Individuals with single seizure or infrequent seizures are unlikely to be suitable candidates since it is difficult to demonstrate a treatment effect in them. The participants should have sufficient time and motivation to continue yoga on a daily basis. They must have sufficient time to commute to the centre for learning yoga, which may be almost daily in the initial stages, and subsequently practise yoga for a minimum of 20 to 30 minutes daily at home. The number of participants enrolled should be sufficient to allow reliable conclusions. There may be a need for a multi-centre study to recruit a sufficient number of participants. In case of a multi-centre study, it would be essential to standardise the interventions. Enrolling individuals from different cultural backgrounds will allow investigation of the effect of cultural bias. It needs to be ascertained whether the participants' inherent belief in yoga or the skills and personality of the yoga instructor contribute to the outcome. Serum levels of AEDs need to be monitored to ensure that the observed results are not due to the variation in serum levels of AEDs. Consent for randomisation to a placebo-controlled study may be difficult, leading to refusal to participate in the study, more so if the controls have to report to the centre at the same time as the intervention group and go back without receiving any treatment. To overcome this, financial incentives may need to be given to the participants. It is possible that the individuals receiving financial incentives may try to please the co-ordinator of the study with favourable results. Alternatively, the controls may be given the intervention after the study period is over (deferred treatment group). It may be difficult to ensure the compliance of the person (whether he or she practises yoga at home regularly).

Quality of the evidence

Type of participants and interventions: The following controversial issues in participant selection and intervention need to be addressed.

1. Can any modifications be made to AEDs during the period of study? If so, it may be difficult to assess whether the beneficial results are due to the intervention or due to changes in the medical treatment. It may be preferable to include only individuals whose AED regimen has been stable and is unlikely to require modifications during the study period.
2. Which type of seizures or epilepsy to choose for the study? Should people with any type of epilepsy be included or individuals with a specific homogenous syndrome such as juvenile myoclonic epilepsy be chosen? It may be difficult to recruit sufficient numbers of individuals if the study is confined to a specific type of seizure or epilepsy syndrome.
3. Which type of yoga to use? There are many types of yoga. The existing studies have utilised Sahaja yoga, Hatha yoga and Transcendental Meditation. Until more data are available, the choice of the type of yoga used as an intervention is likely to be empirical.
4. What interventions should be given to controls? If no intervention is given to controls, it will be difficult to decide if the benefit is due to the intervention itself or due to the additional attention given to the yoga group (attention bias). Hence it may be necessary to have an attention control group by giving sham yoga or exercises mimicking yoga. Even if the controls are asked to come and sit quietly in one place, the accompanying relaxation may give beneficial results.
5. Should participants be used as their own controls and the seizure frequency before and after intervention be compared? This would be an additional outcome measure, though subject to bias.

A cross-over study will be difficult since individuals may continue with yoga even after completion of the treatment phase.

Methods: Randomisation is essential to eliminate selection bias. The ideal method would be by telephone with computer-generated random lists. Consecutively numbered, sealed opaque envelopes would be less expensive, although it is possible that they may be prematurely opened and a bias introduced. Blinding may reduce the observer bias. Physician blinding may be achieved with the outcomes being assessed by a physician who is not involved in the trial. Participant blinding may not be possible, since it would be easy to distinguish whether the intervention given is yoga or not. It would be ideal if the seizure records are maintained by a blinded observer. It would require a lot of co-operation from the individual not to disclose the nature of intervention to the observer, who in most cases would be a parent or spouse or a close family member.

Outcome measures: Reliable maintenance of seizure records will require a close family member, since the individual may not be aware of the episodes. Records of seizure frequency may be inaccurate since seizures occurring during sleep or abortive seizures occurring when the individual is outdoors may not be recorded. Seizure frequency outcomes should preferably be expressed as the proportion of individuals seizure-free or the proportion with more than 50% reduction in seizure frequency, since mean values of seizure frequency are often skewed and difficult to analyse.

Seizure duration may be measured in seconds or minutes (per episode or month). Validity of records of seizure duration maintained by unblinded observers may be questioned. Seizure severity scales may be more sensitive indicators of a treatment effect than seizure frequency data. Validated quality of life measures (disease specific) may indicate whether there is overall improvement in quality of life as a result of the intervention, besides seizure control. Dropouts from the study may cause an attrition bias. The reason for dropout, e.g. whether it is due to lack of efficacy or time constraints or lack of motivation, would be helpful in assessing the true efficacy.

Analysis: The type of analysis that should be undertaken is controversial. An intention-to-treat analysis includes all participants allocated to an intervention, irrespective of whether they actually followed the intervention or not. This would give a pragmatic estimate of the benefit, if a policy is taken to implement the intervention for treatment of epilepsy rather than the potential benefit in individuals who receive treatment exactly as planned. A per protocol analysis may overestimate the actual efficacy of the intervention. When the reason for dropout from the study is not clear, a worst case and best case scenario can be calculated based on the following assumptions: (a) all those not completing the follow-up are non-responders in the intervention group and responders in the control group (worst case); and (b) individuals not completing the follow-up are responders in the intervention group and non-responders in the control group (best case). Mantel-Haenszel odds ratios and 95% confidence intervals (CIs) are estimators for categorical data such as the proportion of individuals seizure-free or 50% responders, while the mean difference and 95% CI may be used for continuous data such as mean seizure frequency.

Potential biases in the review process

Although we requested all protocols, the time frame in which the majority of the studies were conducted made retrieval of all of these difficult. This could lead to potential bias through omitted information we did not have access to.

Agreements and disagreements with other studies or reviews

Despite the study by Deepak 1994 containing a detailed analysis of the results, we decided to exclude it primarily for lack of an acceptable method of randomisation. Deepak 1994 included people with "very frequent seizures" while Panjwani 1996 included individuals with "not so frequent seizures" and hence even if the former study had been included, we could not have combined the results of the two studies.

AUTHORS' CONCLUSIONS

Implications for practice

No reliable conclusions can be drawn at present regarding the efficacy of yoga as a treatment for epilepsy. The complexity of the yoga intervention is similar to other forms of complementary and alternative treatments. Yoga may be an add-on to antiepileptic drugs (AEDs) at the present time and cannot be used as the sole method of intervention.

Implications for research

The addition of further evidence from future studies may change the results and conclusions of this review.

Further research is needed, as follows.

- The trials should describe the details of the inclusion and exclusion criteria (the age and sex distribution of the participants enrolled, age at onset of epilepsy, duration of epilepsy, type of epilepsy, aetiology of epilepsy, presence or absence of mental retardation, progressive neurological disease, psychopathology, co-existing hysterical seizures, and whether they were on medication appropriate to the type of epilepsy in adequate doses as determined by serum levels); the details of the intervention given and how the AED therapy was handled during the study period need to be elaborated.

- A study with a much larger number of participants is needed to clarify the efficacy or lack of efficacy of yoga in the treatment of epilepsy. Centres which evaluate large numbers of people with uncontrolled epilepsy and centres performing epilepsy surgery could set up a randomised controlled trial to evaluate the efficacy of yoga in the treatment of epilepsy. The number of participants enrolled should be sufficient to allow reliable conclusions.

- The trials should have an attention control group by giving sham yoga or exercises mimicking yoga.

- The trials should have an ideal of randomisation (by telephone with computer generated random lists). Physician blinding may be achieved with the outcomes being assessed by a physician who is not involved in the trial. Participant blinding may not be possible, since it would be easy to distinguish whether the intervention given is yoga or not. It would be ideal if the seizures' records are maintained by a blinded observer. It would require a lot of co-operation from the individual not to disclose the nature of intervention to the observer, who in most cases would be a parent or spouse or a close family member.

- A study with a validated quality-of-life measure (disease specific) may indicate whether there is overall improvement in the quality of life as a result of the intervention, besides seizure control.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Lundgren 2008

Methods	Randomised controlled study. Pre-randomisation baseline period: 3 months. Duration of treatment phase: 5 weeks and booster sessions at 6 and 12 months post-treatment Study setting: hospital outpatient clinic.
Participants	A single centre study (India). 18 adults with refractory epilepsy, minimum seizure frequency of 3 episodes in past 3 months. People with progressive illness were excluded The subjects were randomly divided into two groups. • Group I (N = 10, 3 women and 7 men): treated with ACT. • Group II (N = 8, 3 women and 5 men): treated with received yoga. The mean age in group I was 21.9 years, while in group II it was 25.8 years Both groups continued to receive anticonvulsants.
Interventions	Randomised comparison of ACT (group I) and yoga (group II) in subjects with drug-refractory seizures Yoga included Pranayama ('controlled deep breathing'), Asanas ('physical postures'), and Dhyana ('meditation'), Yama ('harmony with others') and Niyama ('harmony with yourself'). ACT was given in 2 sessions (individual session and group session) The treatment protocols consisted of 12 hours of professional therapy distributed in 2 individual sessions, 2 group sessions during a 5-week period, and booster sessions at 6 and 12 months post-treatment
Outcomes	Therapeutic effects were measured using: 'seizure index' (seizure frequency × seizure duration); and quality of life (Satisfaction With Life Scale (SWLS); and World Health Organization Quality of Life instrument, short version (WHOQOL-BREF)) Seizure index was assessed during 3-month baseline and 12-month follow-up using a seizure diary. Quality of life was measured prior to the initiation of treatment, after treatment, and at the 6-month and 12-month follow-ups
Notes	*DAHL 2005 Epilepsia* is linked to this study.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computerised randomisation table.
Allocation concealment (selection bias)	Unclear risk	No details of concealment of allocation.

Lundgren 2008 (*Continued*)

Blinding (performance bias and detection bias) All outcomes	High risk	No blinding because is not applicable with participants and yoga instructor. Outcome assessors not blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants were included in the analysis.
Selective reporting (reporting bias)	Low risk	Included all pre-specified expected outcomes.
Other bias	Low risk	This study appeared to be free of other sources of bias.

Panjwani 1996

Methods	Randomised controlled trial of 32 individuals with uncontrolled epilepsy Pre-randomisation baseline period: 3 months. Duration of treatment phase: 6 months; this period included 0-, 3-, 6-month time-points. Study setting: hospital epilepsy clinic.
Participants	A single centre study (India). 32 adults with clinical diagnosis of idiopathic epilepsy and minimum seizure frequency of 4 episodes in past 3 months The subjects were randomly divided into three groups. • Group I (N = 10, 9 women and 1 man) received Sahaja yoga. • Group II (N = 10, 9 women and 1 man) received exercises mimicking Sahaja yoga. • Group III (N = 12, all women) received no additional intervention. The mean (± SD) age in group I was 24.6 ± 6.6 years, while in groups II and III it was 23.7 ± 7.9 years and 19.7 ± 4.8 years respectively. The mean duration of illness (± SD) was 7.3 ± 3.5 years in group I; 5.6 ± 2.8 in group II; and 4.2 ± 2.4 in group III All groups continued to receive anticonvulsants.
Interventions	Randomised comparison of Sahaja yoga (group I), received exercises mimicking Sahaja yoga (group II), and without any intervention (group III) The intervention group reported to the department on all working days for the first month and thereafter twice a week for the remaining study period (6 months) and practised Sahaja yoga twice daily for 20 to 30 minutes, under the guidance of a trained instructor. Group II participants were provided with the same environment and attention as group I, but did not practice meditation. Group III participants were followed up in the neurological outpatient clinic
Outcomes	Therapeutic effects were measured using: 'seizure frequency' (expressed as attacks per month), noted for 3 months prior to enrolment in the study (0 month), and at 3 and 6 months of the study; and EEG (routine recording was scanned for the presence of epileptiform activity) was recorded at 0, 3 and 6 months Seizure data collection was based on weekly interviews with the participant and his/her accompanying relative

Panjwani 1996 (*Continued*)

Notes	*PANJWANI 2000 Applied Psychophysiology and Biofeedback* is linked to this study.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation by roll of the dice.
Allocation concealment (selection bias)	Unclear risk	No details of concealment of allocation.
Blinding (performance bias and detection bias) All outcomes	High risk	No blinding because is not applicable with participants and yoga instructor. Outcome assessors not blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants were included in the analysis.
Selective reporting (reporting bias)	Low risk	Included all pre-specified expected outcomes.
Other bias	Low risk	This study appeared to be free of other sources of bias.

ACT: Acceptance and Commitment Therapy
EEG: electroencephalogram.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Arias 2006	Ineligible population (people with no epilepsy).
Bleichhardt 2004	Ineligible population (people with no epilepsy).
Büssing 2012	This is a review and not a randomised study.
Chander 2015	No yoga treatment.
CTRI/2010/091/001072	No yoga treatment (reflexology therapy).
Deepak 1994	This is an old abstract. It is not clear if it is a randomised controlled trial and did not report the results. We attempted to clarify with the author regarding the randomisation and the results, but have not received any reply so far

(*Continued*)

Dudani 1989	This is an old conference abstract and it was not possible to contact the authors for details regarding randomisation procedure and the outcomes data
Elsas 2011	No yoga treatment.
Fenwick 1994	No yoga treatment.
Gupta 1991	This is an open study, no control group, no randomisation or blinding
Jaseja 2006A	Not an RCT.
Jaseja 2006B	Not an RCT.
Lidbeck 1997	Ineligible population (people with no epilepsy) and no yoga treatment
McCall 2013	This is a review and not a randomised study.
Meyer 2012	This is a review and not a randomised study.
Nadkarni 1997	The author was contacted for details regarding the randomisation procedure and the outcomes data. At the time of writing this review update, no response had been received from the author
Nanke 2000	Ineligible population (people with no epilepsy).
Nanke 2003	Ineligible population (people with no epilepsy).
NCT00179452 2003	This is a non-randomised study.
NCT00370929 2006	This is a non-randomised study.
Polak 2012	No yoga treatment.
Privitera 2014	This is a non-randomised study.
Privitera 2015	This is an abstract and did not report the results. We attempted to clarify with the author, but have not received any reply so far
Rajesh 2006	This is a non-randomised study.
Ramaratnam 2001	Not an RCT.
Ricotti 2006	No yoga treatment.
Rousseau 1985	This is an old paper and it was not possible to contact the authors for details regarding randomisation procedure and the outcomes data

(*Continued*)

Sathyaprabha 2005	The study investigates the effect of yoga on autonomic dysfunction among people with refractory epilepsy. Effects on seizure frequency do not appear to be the primary outcome investigated. Allocation was by alternation
Saxena 2011	This is a review and not a randomised study.
Shigaki 2006	Ineligible population (people with no epilepsy) and no yoga treatment
Snyder 1983	No yoga treatment.
Sonnen 1972	This is a non-randomised study.
Thompson 2010	No yoga treatment.
Thompson 2015	No yoga treatment.
Timmer 2004	Ineligible population (people with no epilepsy).
Whitman 1990	No yoga treatment.
Yardi 2001	This is a non-randomised study.
Öst 1987	This is a review and not a randomised study.

Characteristics of ongoing studies *[ordered by study ID]*

NCT02950636 2016

Trial name or title	Effect of Yoga on mood and quality of life in patients with refractory epilepsy
Methods	Randomised controlled trial.
Participants	The study population will consist of people (aged 18 to 75 years) with refractory epilepsy
Interventions	Yoga treatment (Restorative Yoga).
Outcomes	This trial will determine the following: Primary Outcome Measures: Change in Neurological Disorders Depression Inventory for Epilepsy (NDDI-E) [Time Frame: Change from Week 4 to Week 12]. The NDDI-E is a 6-item questionnaire. Scores for each question range from 1 (never) to 4 (all the time). There is a maximum score of 24. The higher the score the more severe the depression. Secondary Outcome Measures: Change in Generalized Anxiety Disorder 7-item (GAD-7) scale [Time Frame: Change from Week 4 to Week 12]. The GAD-7 is a 7-item questionnaire. Scores for each question range from 0 (not at all) to 3 (nearly every day). There is a maximum score of 21. The higher the score the more severe the anxiety. A score over 15 represents severe anxiety. A score under 10 may indicate GAD and would prompt further examination.

NCT02950636 2016 (*Continued*)

	Change in Quality of Life in Epilepsy-Patient-Weighted (QOLIE-31-p) [Time Frame: Change from Baseline to Week 12]. The QOLIE-31-p is a 38-item questionnaire. Scores range from 0 to 100. Higher scores relate to higher distress. Frequency of seizures [Time Frame: Week 12]. Count of seizures in study subjects
Starting date	December 2016
Contact information	Dr. Catherine Lauridsen, University of Kansas Medical Center, USA, clauridsen@kumc.edu
Notes	

DATA AND ANALYSES

Comparison 1. Yoga versus no yoga

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Seizures six months after treatment	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Seizure free (yoga versus sham yoga)	1	20	Odds Ratio (M-H, Fixed, 95% CI)	14.54 [0.67, 316.69]
1.2 Seizure free (yoga versus none)	1	22	Odds Ratio (M-H, Fixed, 95% CI)	17.31 [0.80, 373.45]
2 Seizure frequency (number per month)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Seizure frequency (yoga versus sham yoga)	1	20	Mean Difference (IV, Fixed, 95% CI)	-2.1 [-3.15, -1.05]
2.2 Seizure frequency (yoga versus none)	1	22	Mean Difference (IV, Fixed, 95% CI)	-1.10 [-1.80, -0.40]
3 Greater than 50% reduction in seizure frequency - six months	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Greater than 50% reduction in seizure frequency (yoga versus sham yoga)	1	20	Odds Ratio (M-H, Fixed, 95% CI)	81.00 [4.36, 1504.46]
3.2 Greater than 50% reduction in seizure frequency (yoga versus none)	1	22	Odds Ratio (M-H, Fixed, 95% CI)	158.33 [5.78, 4335.63]
4 Greater than 50% reduction in seizure duration - six months	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Greater than 50% reduction in seizure duration (yoga versus sham yoga)	1	20	Odds Ratio (M-H, Fixed, 95% CI)	45.0 [2.01, 1006.75]
4.2 Greater than 50% reduction in seizure duration (yoga versus none)	1	22	Odds Ratio (M-H, Fixed, 95% CI)	53.57 [2.42, 1187.26]

Comparison 2. Yoga versus Acceptance Commitment Therapy (ACT)

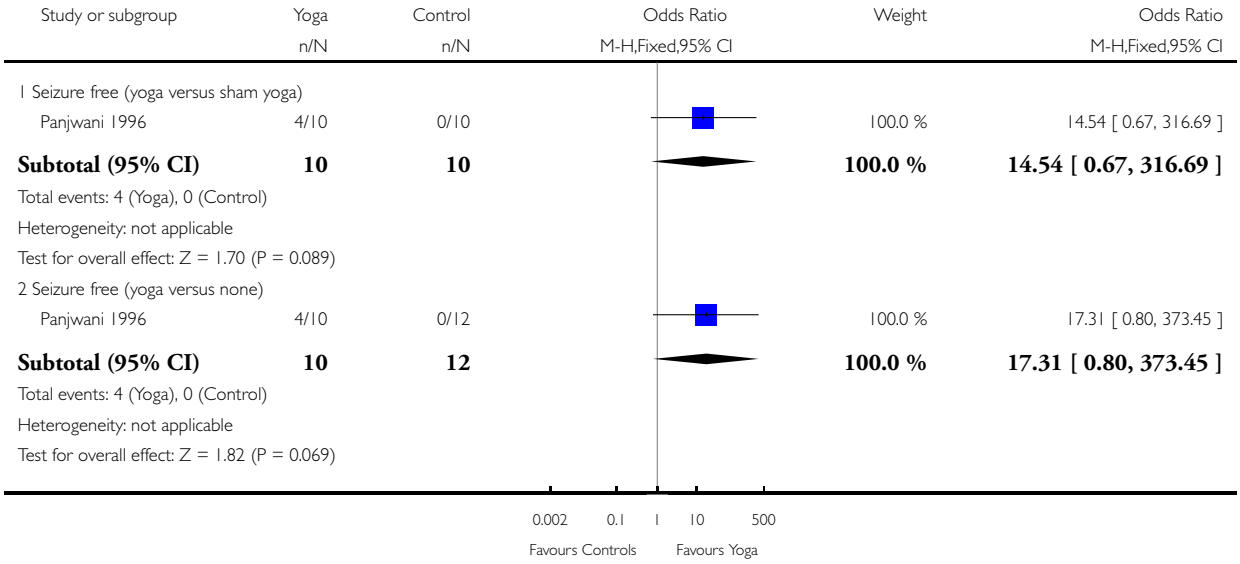
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Seizure free at 1 year follow-up	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
2 50% or greater reduction in seizure frequency	1	18	Odds Ratio (M-H, Fixed, 95% CI)	0.78 [0.04, 14.75]
3 50% or greater reduction in seizure duration	1	18	Odds Ratio (M-H, Fixed, 95% CI)	0.67 [0.10, 4.35]

Analysis 1.1. Comparison 1 Yoga versus no yoga, Outcome 1 Seizures six months after treatment.

Review: Yoga for epilepsy

Comparison: 1 Yoga versus no yoga

Outcome: 1 Seizures six months after treatment

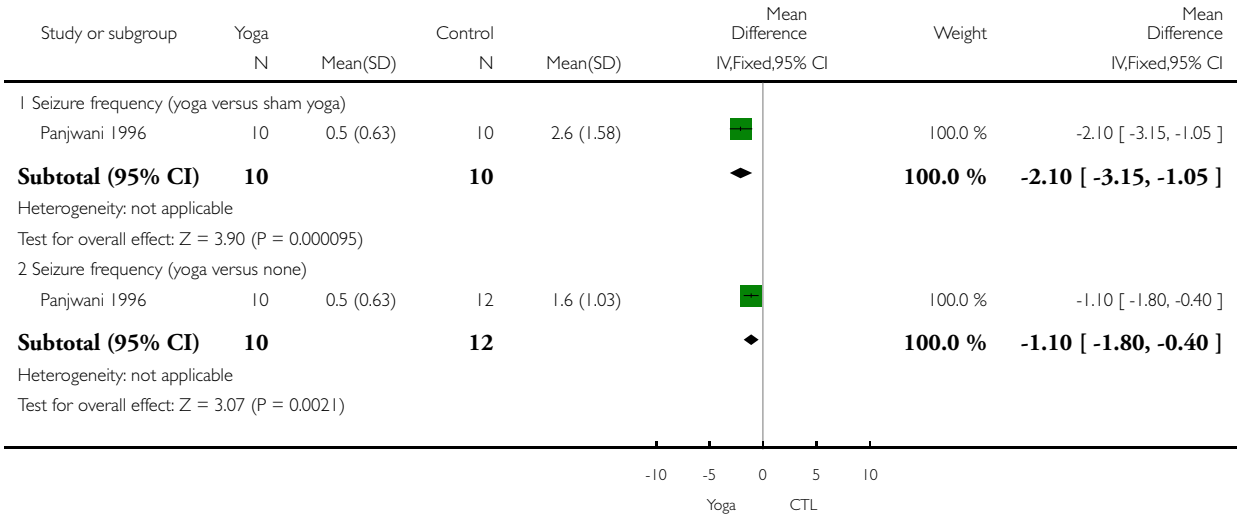


Analysis 1.2. Comparison 1 Yoga versus no yoga, Outcome 2 Seizure frequency (number per month).

Review: Yoga for epilepsy

Comparison: 1 Yoga versus no yoga

Outcome: 2 Seizure frequency (number per month)



Analysis 1.3. Comparison 1 Yoga versus no yoga, Outcome 3 Greater than 50% reduction in seizure frequency - six months.

Review: Yoga for epilepsy

Comparison: 1 Yoga versus no yoga

Outcome: 3 Greater than 50% reduction in seizure frequency - six months

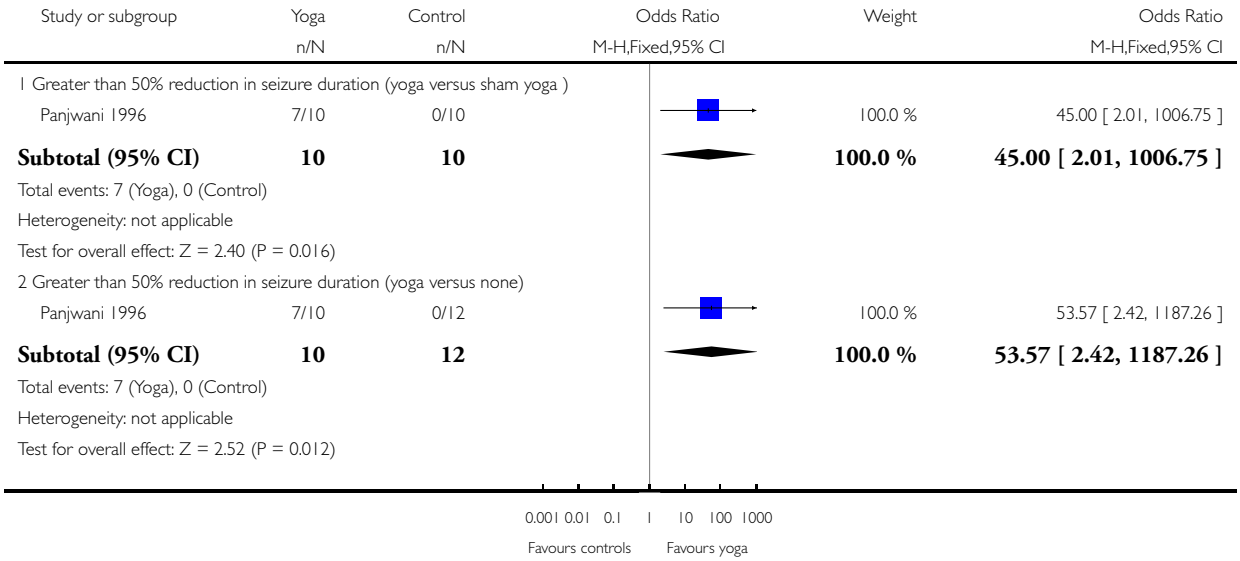
Study or subgroup	Yoga n/N	Control n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
1 Greater than 50% reduction in seizure frequency (yoga versus sham yoga)					
Panjwani 1996	9/10	1/10		100.0 %	81.00 [4.36, 1504.46]
Subtotal (95% CI)	**10**	**10**		**100.0 %**	**81.00 [4.36, 1504.46]**
Total events: 9 (Yoga), 1 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.95 (P = 0.0032)					
2 Greater than 50% reduction in seizure frequency (yoga versus none)					
Panjwani 1996	9/10	0/12		100.0 %	158.33 [5.78, 4335.63]
Subtotal (95% CI)	**10**	**12**		**100.0 %**	**158.33 [5.78, 4335.63]**
Total events: 9 (Yoga), 0 (Control)					
Heterogeneity: not applicable					
Test for overall effect: Z = 3.00 (P = 0.0027)					

Analysis 1.4. Comparison 1 Yoga versus no yoga, Outcome 4 Greater than 50% reduction in seizure duration - six months.

Review: Yoga for epilepsy

Comparison: 1 Yoga versus no yoga

Outcome: 4 Greater than 50% reduction in seizure duration - six months

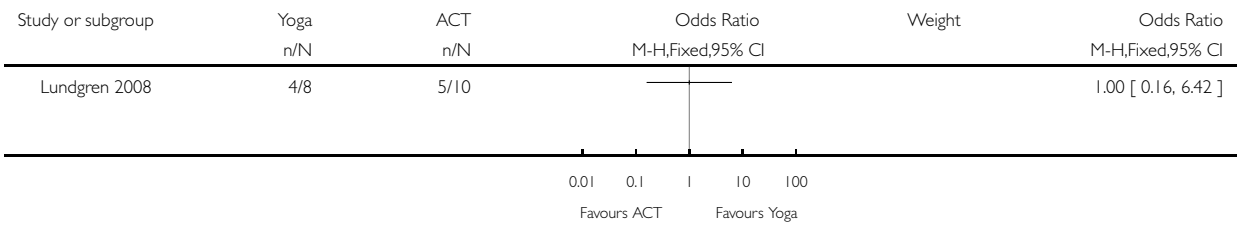


Analysis 2.1. Comparison 2 Yoga versus Acceptance Commitment Therapy (ACT), Outcome 1 Seizure free at 1 year follow-up.

Review: Yoga for epilepsy

Comparison: 2 Yoga versus Acceptance Commitment Therapy (ACT)

Outcome: 1 Seizure free at 1 year follow-up

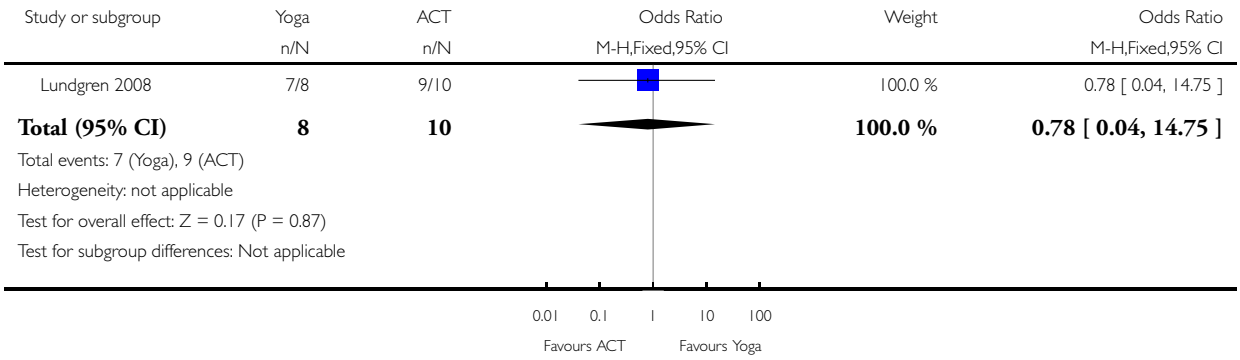


Analysis 2.2. Comparison 2 Yoga versus Acceptance Commitment Therapy (ACT), Outcome 2 50% or greater reduction in seizure frequency.

Review: Yoga for epilepsy

Comparison: 2 Yoga versus Acceptance Commitment Therapy (ACT)

Outcome: 2 50% or greater reduction in seizure frequency

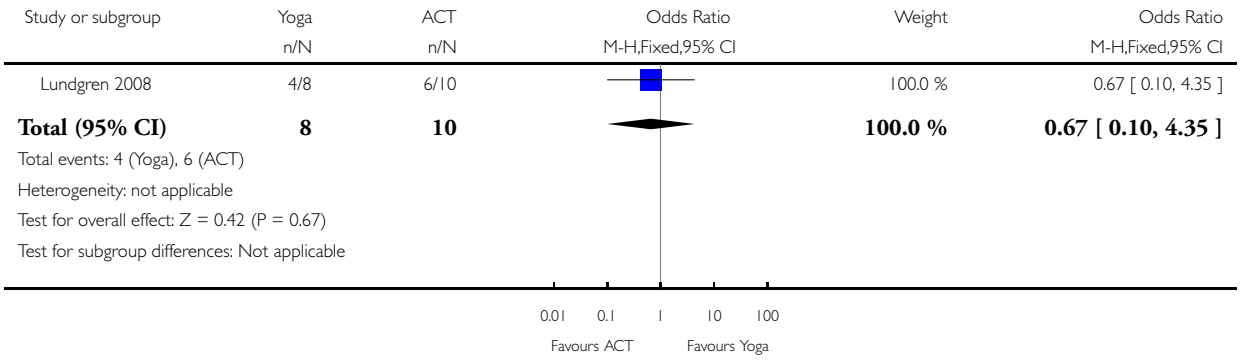


Analysis 2.3. Comparison 2 Yoga versus Acceptance Commitment Therapy (ACT), Outcome 3 50% or greater reduction in seizure duration.

Review: Yoga for epilepsy

Comparison: 2 Yoga versus Acceptance Commitment Therapy (ACT)

Outcome: 3 50% or greater reduction in seizure duration



ADDITIONAL TABLES

Table 1. Number of seizures per month (mean (SD))

	Group I	Group II	Group III
Baseline	3.2 (1.89)	3.0 (2.21)	1.7 (1.03)
After six months	0.5 (0.63)	2.6 (1.58)	1.6 (1.03)

These data are from the Panjwani 1996 trial.

APPENDICES

Appendix 1. Epilepsy Specialized Register search strategy

1. yoga or relaxation or meditation or pranayama or asanas
2. >26/03/2015:CRSCREATED
3. #1 AND #2

Appendix 2. CENTRAL search strategy

#1 MeSH descriptor: [Yoga] explode all trees
#2 MeSH descriptor: [Relaxation Therapy] explode all trees
#3 yoga or meditation or pranayama or asanas
#4 relax* near/3 (therap* or treat*):ti,ab,kw (Word variations have been searched)
#5 #1 or #2 or #3 or #4
#6 (epilep* or seizure* or convuls*):ti,ab,kw (Word variations have been searched)
#7 MeSH descriptor: [Epilepsy] explode all trees
#8 MeSH descriptor: [Seizures] explode all trees
#9 (#6 or #7 or #8) in Trials
#10 #5 and #9

Appendix 3. MEDLINE (Ovid) 1946- search strategy

1. exp Yoga/
2. exp Relaxation Therapy/
3. (yoga or meditation or pranayama or asanas).tw.
4. (relax$ adj3 (therap$ or treat$)).tw.
5. 1 or 2 or 3 or 4
6. exp Epilepsy/
7. exp Seizures/
8. (epilep$ or seizure$ or convuls$).tw.
9. 6 or 7 or 8
10. exp *Pre-Eclampsia/ or exp *Eclampsia/
11. 9 not 10
12. (randomized controlled trial or controlled clinical trial or pragmatic clinical trial).pt. or (randomi?ed or placebo or randomly).ab.
13. clinical trials as topic.sh.
14. trial.ti.
15. 12 or 13 or 14
16. exp animals/ not humans.sh.
17. 15 not 16
18. 5 and 11 and 17
19. remove duplicates from 18
20. limit 19 to ed=20150326-20170103

Appendix 4. ClinicalTrials.gov search strategy

(yoga OR meditation OR pranayama OR asanas OR "relaxation therapy") AND epilepsy | Studies received on or after 03/26/2015

Appendix 5. WHO International Clinical Trials Registry Platform (ICTRP) search strategy

yoga AND epilepsy NOT NCT*

WHAT'S NEW

Date	Event	Description
3 January 2017	New citation required but conclusions have not changed	Conclusions are unchanged.
3 January 2017	New search has been performed	Searches were updated on 3 January 2017; no new studies were identified

HISTORY

Protocol first published: Issue 1, 1998

Review first published: Issue 3, 1999

Date	Event	Description
26 March 2015	New citation required but conclusions have not changed	Conclusions are unchanged.
26 March 2015	New search has been performed	Searches were updated on 9 January 2014; no new studies were identified. Pre-publication searches were carried out on 26 March 2015; again no new studies were identified
16 May 2011	New search has been performed	Searches updated 16 May 2011; no new studies identified. One study earlier included as awaiting assessment has been added as an excluded study (Sathyaprabha 2005).
24 October 2008	Amended	Search strategy amended to comply with RevMan 5.
21 August 2008	Amended	Converted to new review format.
31 August 2006	New search has been performed	Searches updated 1 September 2006. Two new studies found. These studies have been assessed, one has been added to the excluded studies section (Sathyaprabha

(*Continued*)

		2005) and one has been added to the awaiting assessment section (Dahl 2005).

CONTRIBUTIONS OF AUTHORS

Sridharan Ramaratnam and Kalpana Sridharan participated in the data search and assessed studies for eligibility, extracted data and assessed risk of bias. Mariangela Panebianco was responsible for writing this update and completed data extraction and risk of bias assessments.

DECLARATIONS OF INTEREST

MP: none known.

KS: none known.

SR: none known.

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- National Institute for Health Research, UK.

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

None stated.

INDEX TERMS

Medical Subject Headings (MeSH)

*Yoga; Acceptance and Commitment Therapy; Drug Resistant Epilepsy [etiology; *therapy]; Quality of Life; Randomized Controlled Trials as Topic; Seizures [therapy]; Stress, Psychological [complications; therapy]

MeSH check words

Adult; Humans