

**Identifying Alternative Mental Health Interventions: A Systematic Review of
Randomized Controlled Trials of Chanting and Breathwork**

Abstract

This systematic review of randomized controlled trials investigated the effects of two religious/spiritual (R/S) practices (breathwork and chanting) on mental health outcomes (depression, anxiety, stress, and post-traumatic stress disorder (PTSD) symptoms). After registering with PROSPERO (CRD42020136645), a systematic search of four major databases (CINAHL, MEDLINE, PsycINFO, and ProQuest) was undertaken using predetermined eligibility criteria. Quality of included studies was assessed using the PEDro scale and Cochrane risk of bias tool. Although varying in quality, fifteen included studies provide moderate to strong support for the effectiveness of chanting and breathwork to alleviate anxiety, depression, stress, and symptoms of PTSD.

Keywords: Religious practices, spiritual practices, mental health, breathwork, chanting, sensorimotor, depression, anxiety.

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1. Introduction

Mental health disorders are the major cause of disability worldwide (Wang et al., 2007). Collectively, mental health and addictive disorders affected more than 1 billion people globally in 2016 (Rehm & Shield, 2019). Mental health disorders contribute 13% of disability-adjusted life years (years of life lost due to premature death/fatal burden), and 32.4% of years with disability (years of healthy life lost due to poor health) globally (Vigo et al., 2016). In Australia, mental health and substance use disorders were the second largest (23%) contributor towards the non-fatal burden of disease, and the fourth largest (12%) contributor to the total burden of disease in 2015 (Australia Health & Welfare, 2021). In the United States, 20.6% of the total population (estimated 51.5 million) of adults aged 18 or older were diagnosed with some form of mental illness (McCance-Katz, 2019).

According to a world mental health survey of 17 low, medium, and high-income countries, mental health care needs were inadequately met across all countries (Wang et al., 2007). This is despite the provision of extensive mental health services, rehabilitation, and preventive endeavors available through government and non-government healthcare systems. **More recently, Lake and Turner (2017) also noted that existing interventions have not adequately addressed mental health needs, highlighting a need to investigate supplementary evidence-based mental health interventions that can be integrated into current mental health services.**

The COVID-19 pandemic has further limited access to quality and affordable mental health care (United Nations Sustainable Development Group [UNSDG], 2020). In response, the United Nations has stressed the importance of identifying alternative and supplementary modalities of mental health interventions as a national response for all countries (UNSDG, 2020). The aim of the present review is to investigate the highest level of evidence regarding

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whether specific practices inherent in religion or spiritual traditions may have mental health benefits warranting consideration as supplementary interventions to support mental health.

1.1. Religious and spiritual practices

Long before mental health interventions were formalized, religious and spiritual (R/S) traditions have sustained humankind. Religion and spirituality are both complex constructs that are difficult to define, and there is no consensus regarding how these terms relate to each other (Worthington & Sandage, 2001). Religion includes doctrinal concepts, collective beliefs, rituals, and traditions prescribed by a group of people or an institution (Hick, 2004). Spirituality or spiritual experience, however, can be described as an individual experience, the dissolution of individual identity, a sense of unity or oneness with others, or something larger than oneself (Luskin, 2004). Practices inherent to a religion can be termed religious practices; however, spiritual practices need not be affiliated with any particular religion. For the purpose of this review, all spiritual philosophies/traditions that are not affiliated with any religion will be referred to as spiritual traditions and their practices as spiritual practices.

1.2. Sensorimotor R/S practices

The word “sensory” means related to bodily sensation, while the term “motor” implies movement; hence, “sensorimotor” practices are those practices that incorporate senses and involve a certain level of physical activity (Smith, 2019). There are a wide range of R/S practices that have sensory and motor components and can therefore be termed sensorimotor R/S practices; for example, chanting, vocal recitation of scriptures, meditative movements, breathwork, devotional singing, and praise dancing. These practices provide tangible means through which people find comfort and solace through the experience of self-transcendence (Newberg & d'Aquili, 2000; Perry et al., 2021). The experience of self-transcendence is explained as a transient mental state with low or no sense of self and increased feeling of union or connectedness (Yaden et al., 2017). The neurological effects of the repetitive

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rhythmic behavior that characterizes sensorimotor R/S practices have been associated with mild to extreme self-transcendent experiences in a bottom-up fashion, from the more primitive physical/sensory level to the more evolved cognitive level (Newberg & d'Aquili, 2000). To our knowledge, a clear definition of sensorimotor R/S practices has not been documented. For the purpose of this review, sensorimotor R/S practices are defined as those practices that originate in a religion or spiritual tradition and incorporate both sensory and motor components.

1.3. Sensorimotor R/S practices and mental health

Despite increasing empirical evidence of the role played by spirituality and religion in supporting mental health, Egan and Timmins (2019) revealed a lack of research regarding the integration of religious and spiritual interventions into public mental health settings. Five reviews have investigated the effectiveness of R/S practices as interventions in mental health.

The studies included in these reviews investigated R/S practices related to education and/or cultivation of positive virtues such as forgiveness and gratitude (Bonelli & Koenig, 2013; Cotton et al., 2006; Gonçalves et al., 2015; Koenig, 2009; Ross et al., 2015). While these R/S practices are sources of great comfort, they are not sensorimotor in nature. There have been systematic reviews investigating the effects of various R/S practices that involve sensory and motor components on mental health, including yoga (Balasubramaniam et al., 2013; Brinsley et al., 2020; Hendriks et al., 2017; Sharma, 2014), and qi gong and tai chi (Liu et al., 2015). While these reviews support the positive effect of these R/S practices on mental health, the evidence for other sensorimotor R/S practices has not been systematically reviewed.

1.4. Current Review

The aim of the present systematic review is to address the lack of integration of evidence regarding the implications of selected sensorimotor R/S practices on common mental health

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outcomes by evaluating the highest level of evidence – randomized controlled trials (RCTs).

While there are number of R/S practices that meet our criteria of sensorimotor R/S practices, yoga (related to physical postures), qi gong, and tai chi have been excluded because, as mentioned above, these have already been reviewed. In this review, we considered four sensorimotor R/S practices – R/S breathing (breathwork), R/S chanting, R/S singing, and R/S movement – on anxiety, depression, stress, and PTSD symptoms. We selected these practices because they have their origin in a religion or a spiritual tradition and were sensorimotor in nature. As such, only those studies, that considered one or more of these four R/S practices with both sensory (use of senses such as auditory, vision, tactile) and motor components (for example breathing, oral and other body movements) were included.

In this review, *breathwork* refers to all breathing practices that have R/S origins, such as yogic breathing. *Breathwork* is considered a sensorimotor practice because it involves senses and body movements to control and change breathing rate and depth. *Chanting* refers to R/S practices involving repetition of a R/S word or phrase. Chanting can be done silently or out loud, with or without involvement of other body movements such as finger movements with beads. Since our review is focused on sensorimotor chanting, we only included studies that used chanting with vocalizations and/or body movements. *R/S singing* involves singing songs out loud with R/S themes, including hymns and praise songs. *R/S movement* refers to practices that have their origin in a R/S tradition and involve distinct body movements such as yoga and tai chi.

2. Methods

2.1. Protocol and registration

The protocol of the systematic review was registered on The International Prospective Register of Systematic Reviews (PROSPERO), identification number CRD42020136645.

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The review was conducted and reported according to the Preferred Reporting Items for Systematic Review Guidelines (PRISMA) (Moher et al., 2009).

2.2. Information sources and search strategy

Four leading databases were searched: CINAHL, MEDLINE, PsycINFO, and ProQuest. A systematic and comprehensive search strategy with relevant key terms and MESH terms was developed. The search strategy was adapted as per guidelines of individual databases (see the example for MEDLINE, Table 1). Searches were limited to the English language and randomized controlled trials. Search strategies of all databases are available in the supplementary material. Hand searches of reference lists and additional sources such as Google Scholar were conducted. Unpublished studies, case reports, and grey literature were not included in the review. Covidence software was used to screen studies, and to conduct quality assessment and data extraction. Screening of studies was done in two phases. In phase one, the first author (SM) assessed titles and abstracts against eligibility criteria. Two additional authors (PM and BZ) collectively screened the titles and abstracts as second reviewers. Phase two screening followed the same process with full-text articles. Discrepancies in selection were resolved by discussion until mutual agreement was achieved.

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2.3. Study selection and eligibility criteria

For the purpose of this systematic review, the authors included only peer-reviewed randomized controlled trials that investigated the effects of at least one of four sensorimotor practices (breathwork/chanting/ R/S singing/ R/S movements) on four mental health outcomes (anxiety, depression, stress, and PTSD symptoms). Both healthy and clinical participants of any age or sex were considered in the review. Studies were included if they measured mental health outcomes via a focused measure (e.g., a measure specific to anxiety)

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or as part of a broader assessment tool or battery (e.g., anxiety measured as a subtest within a larger scale). A detailed description of eligibility criteria is given in Table 2.

With the key search term, R/S movements, a large number of results were retrieved that included practices such as yoga (body postures), qi gong, and tai chi. As noted previously, there are number of systematic reviews on yoga (Balasubramaniam et. al., 2013; Hendriks et. al., 2017; Sharma & Haider, 2013), and one on qi gong and tai chi (Liu et al., 2015); thus, we excluded studies that used these practices. No RCTs on other forms of R/S movement or RCTs examining associations between R/S singing and mental health outcomes of interest were retrieved during the search.

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2.4. Quality appraisal and risk of bias

Two authors (SM and LK) independently completed the quality assessment and risk of bias assessment for the included studies. Any differences in ratings were resolved with discussion until mutual agreement. The quality of evidence was assessed using the PEDro which evaluates RCTs using a score ranging from 0 to 10, with higher scores suggesting better quality (Maher et al., 2003). The Cochrane risk of bias tool was used to assess the risk of bias in RCTs across six domains: selection bias, performance bias, attrition bias, reporting bias, and other bias by assigning ratings of high, low, and unclear (Higgins et al., 2011).

2.5. Data extraction

Data was extracted by two authors (SM, LK) and tabulated using the following categories: (1) Lead author and year of publication; (2) Country and setting; (3) Sample characteristics (including mean age, sex, number of participants in intervention and/or comparison and control group, and diagnosis of the participants); (4) Outcome measure; (5) Intervention for experimental and control/comparison groups; and (6) Summary of findings (see Table 5).

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3. Results

3.1. Search results

Results of the searches and screening process are outlined in Figure 1. Database searches retrieved a total of 643 studies. After removing 88 duplicates, 555 studies were screened in phase one, and 128 full-text articles were screened in phase two. Of these, 105 articles were excluded due to incorrect intervention, three based on study design, four based on incorrect outcome measures, and one due to language other than English. Fifteen RCTs were reviewed.

3.2. Result of Quality appraisal and risk of bias

Results of the PEDro quality assessment are outlined for the individual studies in Table 3. The overall quality of the 15 studies varied: 12 (80%) were rated as high quality (PEDro score 6-10) and three (20%) were fair (PEDro score 4-5).

-----Please insert Table 3 about here-----

Results of the Cochrane risk of bias tool are outlined for the individual studies in Table 4. Most studies were low in bias for random sequence generation (n=12; 80%), attrition (n=12; 80%); and for other sources of bias (n=13; 86.7%). High levels of bias regarding blinding of participants and personnel (n=13; 86.7%) and blinding of outcome assessment (n=14; 93.3%) were identified for the majority of studies. Ratings of bias for selective outcome reporting were mainly unclear (n=10; 66.7%). While most studies revealed a high risk of bias in blinding of participants and outcome assessors, the overall risk of bias of all other components was low across all studies.

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3.3. Characteristics of Included Studies

As shown in Table 5, all identified studies were conducted within the last 20 years. Of the 15 studies retained in this review, 982 *participants* were included from four *countries*: six (40%) studies from the United States of America, six (40%) from India, two (13.33%) from

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Iran, and one (6.66%) from Malaysia. Individual characteristics of studies and participants are described below.

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3.4. Participant characteristics

Although all 15 included studies considered associations between R/S practices and one of four mental health outcomes, the *clinical diagnosis* of the populations included in the studies varied considerably. Four (26.66%) were conducted with people with mental illness including major depressive disorder (Sharma et al., 2017), anxiety and adjustment disorders (Sureka et al., 2014), melancholia (Janakiramaiah et al., 2000), and PTSD (Seppälä et al., 2014). Three (20%) studies considered people with substance dependence (Maziha et al., 2018; Sureka et al., 2015; Vedamurthachar et al., 2006), and one (6.66%) considered older adults with subjective cognitive decline (Innes et al., 2016). Two (13.33%) studies considered the effect of sensorimotor R/S practices on mental health issues associated with physical illness, specifically cancer (Dhruva et al., 2012) and Guillain-Barre (GB) syndrome (Sendhilkumar et al., 2013). Two (13.33%) further studies investigated the effect of R/S practices on mental health issues of individuals undergoing surgeries including coronary angiography (Bidgoli et al., 2016), and cardiac angiography bypass graft (Nasiri et al., 2016). Two (13.33%) studies were conducted with physically healthy individuals with minor mental health issues (Saoji et al., 2018; Schmalzl et al., 2018), and one (6.66%) with caregivers of people with dementia with mild to moderate depression (Lavretsky et al., 2013).

The *age of participants* varied across the 15 studies. Four (26.6%) studies were conducted with young adults (18-35 years), five (33.33%) with middle-aged adults (36-55 years), and five (33.33%) with older adults (older than 55 years). One study did not state participants' age (Maziha et al., 2018).

3.5. Contexts/settings of included studies

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Six (40%) studies were conducted in inpatient-hospital settings; two of these (13.33%) were in the intensive care unit (ICU). Two (13.33%) further studies were conducted in outpatient-hospital settings, and five (33.33%) in a university/community setting. Two (13.33%) studies were conducted in a prison setting.

3.6. Focus of outcomes

Of the four outcomes of interest, anxiety and depression were the most studied. Eleven (73.33%) studies examined the effect of sensorimotor R/S practices on anxiety, 11 (73.33%) on depression, three (20%) on stress, and only one (6.66%) on PTSD symptoms.

3.7. Outcome measurement

Across all included papers, self-report measures were most common, used in 14 of the 15 studies (93.33%) included in this review. Clinician-rated measures were included in three studies (20%). One study exclusively used clinician-rated measures (Lavretsky et al., 2013), whilst two used clinician-rated measures along with participant self-report (Janakiramaiah et al., 2000; Sharma et al., 2017). In all cases, the clinician-rated measure used was the Hamilton Rating Scale for Depression (HRSD) (Hamilton, 1986).

In the 11 (73.3%) studies that measured *anxiety*, all used at least one self-report measure, with the Hospital Anxiety and Depression Scale (HADS) (Snaith, 2003) the most used scale. Seven (63.63%) of these 11 studies used anxiety measures focussed solely on anxiety while the remaining four (36.36%) studies measured anxiety as a component/subset of a broader outcome measure.

All 11 (73.33%) studies investigating *depression* also used self-report measures, with the Beck Depression Inventory (BDI) (Beck et al., 1996) and Hospital Anxiety and Depression Scale (HADS) (Stern, 2014) the most frequently used. Seven of these 11 (63.63%) studies used measures focused only on depression whereas, in four (36.36%) studies, depression was only measured as a subset of the broader outcome measure.

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All three studies (20%) that investigated *stress* used the Perceived Stress Scale (PSS) (Cohen et al., 1994). The only study (6.6%) that examined *PTSD symptoms* used the PTSD Checklist-Military version (PCL-M) as the outcome measure (Yarvis et al., 2012).

3.8. Breathwork as an intervention

Of the 15 included studies, 11 studies (73.33%) investigated breathwork. Duration and length of breathwork intervention varied across studies. Duration of breathwork interventions ranged from five minutes (Bidgoli et al., 2016) to 90 minutes (Seppälä et al., 2014) while the length of intervention ranged from one day (Bidgoli et al., 2016) to up to eight weeks (Saoji et al., 2018). Authors of some studies reported participant compliance and acceptability of breathwork among participants (Dhruva et al., 2012; Seppälä et al., 2014; Sharma et al., 2017; Sureka et al., 2014; 2015). While several authors identified breathwork as a cost-effective and feasible intervention in clinical settings (Bidgoli et al., 2016; Dhruva et al., 2012), they did not specifically evaluate cost-effectiveness or feasibility as part of the study. Only one study reported any adverse events – Schmalzl et al. (2018) stated that participants reported temporary discomfort in muscles after the breathing practices.

The effectiveness of breathwork on *anxiety* was investigated in eight (53.33%) of the 15 included studies. Statistically significant reduction in anxiety symptoms was reported across all studies. In one study (Dhruva et al., 2012), dose-response relationship analysis revealed that for every hour of increase in breathwork practice, there was a statistically significant reduction in anxiety.

Eight (53.33%) studies investigated the effect of breathwork on *depression*. Breathwork was shown to reduce depressive symptoms in all eight studies, but the reduction only reached statistical significance in five studies (Janakiramaiah et al., 2000; Sendhilkumar et al., 2013; Sharma et al., 2017; Sureka et al., 2014; Vedamurthachar et al., 2006). Though not statistically significant, a repeated measures analyses of breathwork dose effect (i.e.,

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dose-response relationship) conducted in one study revealed that increases in breathwork practice resulted in decreases in the level of depression (Dhruva et al., 2012). One study compared breathwork **with mental health interventions such as electroconvulsive therapy (ECT)** and Imipramine for depression (Janakiramaiah et al., 2000). This study reported that breathwork was not as effective as ECT but equaled the effectiveness of Imipramine in patients with major depressive disorder. In another study, a significant reduction in depression was reported with breathwork for people who did not respond adequately to standard treatments for depression (Sharma et al., 2017).

The effect of breathwork on *stress* was only investigated in two studies (Dhruva et al., 2012; Schmalzl et al., 2018), only one of which reported a statistically significant reduction in stress level (Schmalzl et al., 2018). The effect of breathwork on *PTSD symptoms* was examined in one study (Seppälä et al., 2014) using a waitlist control design. Seppala et al. (2014) reported that the experimental group showed a significant reduction in PTSD symptoms after the intervention, which was maintained at one year follow-up.

3.9. Chanting as an intervention

The effect of chanting on mental health outcomes was investigated in four studies. Two of the four studies used kirtan kriya which is an intervention that involves vocal chanting with repetitive finger movements (Innes et al., 2016; Lavretsky et al., 2013). The duration of chanting intervention varied. Participants used kirtan kriya for 12 minutes per day, for between eight (Lavretsky et al., 2013) and twelve weeks (Innes et al., 2016). The other two studies used repetition of phrases from Islamic scripture (Maziha et al., 2018; Nasiri et al., 2016), with treatment length ranging from three days (Nasiri et al., 2016) to four weeks (Maziha et al., 2018). None of the studies reported any adverse events.

Three of four studies investigated the effect of chanting on *anxiety*, with all three reporting statistically significant reductions in anxiety levels (Innes et al., 2016; Maziha et al.,

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2018; Nasiri et al., 2016). Three studies examined *depression* (Innes et al., 2016; Lavretsky et al., 2013; Maziha et al., 2018) and, while depression was reduced in all three studies, the reduction was only significant in one study (Innes et al., 2016). One study (25%) investigated perceived *stress* (Innes et al., 2016) which was significantly reduced with chanting. None of the studies investigated the effect of chanting on *PTSD symptoms*.

4. Discussion

The aim of this systematic review was to investigate findings from randomized controlled trials (RCT) regarding the effects of four sensorimotor R/S practices (breathwork, chanting, R/S singing, and R/S movements) on four mental health outcomes (anxiety, depression, stress, and PTSD symptoms). No RCTs were retrieved that related to R/S singing or movements. The 15 included studies investigated the effect of breathwork (11 studies) and chanting (four studies) on anxiety, depression, stress, and PTSD symptoms in both clinical and non-clinical samples. In general, the findings of the review suggest that both breathwork and chanting reduced levels of depression and anxiety. While both practices were also effective in reducing stress levels, the results need to be considered cautiously as only two RCTs investigating the impact of breathwork on stress levels, and one RCT for chanting, were found. Though findings of the effectiveness of breathwork in PTSD were encouraging, only one RCT investigated this outcome.

4.1. Effectiveness of interventions

4.1.1. Breathwork

Findings of this review regarding the effectiveness of breathwork in reducing depression and anxiety are promising. Five of the eight studies reported statistically significant improvement in the level of *depression* with breathwork (Janakiramaiah et al., 2000; Sendhilkumar et al., 2013; Sharma et al., 2017; Sureka et al., 2014) while eight studies found a significant reduction in *anxiety* levels (Bidgoli et al., 2016; Dhruva et al., 2012; Saoji

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et al., 2018; Sendhilkumar et al., 2013; Seppälä et al., 2014; Sharma et al., 2017; Sureka et al., 2014, 2015). Additionally, a dose-response analysis found a significant reduction in anxiety after every additional hour of increase in breathwork practice (Dhruva et al., 2012). Interestingly, in one RCT, breathwork was as effective as a mainstream antidepressant medication Imipramine (Janakiramaiah et al., 2000), suggesting the potential use of breathwork for people who do not have access to, or who are reluctant to take medications. In another RCT, breathwork was effective for individuals who did not respond adequately to standard treatment for depression (Sharma et al., 2017). Results of the study (Sharma et al., 2017) are particularly promising as approximately 50% of individuals do not respond to first-line antidepressants (Connolly & Thase, 2011; Sinyor et al., 2010). Evidence relating to the effect of breathwork on *stress* and *PTSD symptoms* were encouraging; however, they were limited, with only two studies considering stress and one PTSD symptoms. In an RCT with veterans with PTSD, improvements in PTSD symptoms were maintained at 12 months follow up (Seppälä et al., 2014) which suggests possible use of breathwork as a supplementary intervention for individuals with PTSD.

Overall, findings suggest that breathwork may be a beneficial adjunctive intervention for people with depression and anxiety. Although studies in this review included only behavioral measures, our findings were consistent with a recent review that investigated the efficacy of yoga (including breathwork) in mental health outcomes using measures such as neuro-physiological changes, neuroimaging, and biomarkers (Bhargav et al., 2020). Our findings are also aligned with qualitative research conducted with people with clinical depression where participants reported reductions in depression with breathwork which included a focus on understanding the mechanism of change (Benicewicz, 2015). Consistent findings from studies using different outcome measures and research methodologies support

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the evidence of the effectiveness of breathwork in mental health and instill more confidence in using this practice as an intervention.

4.1.2. *Chanting*

This review included studies that used chanting with one or more sensorimotor components. A positive trend was noted across all four studies in improving anxiety, depression, and stress. Three studies investigating *anxiety* reported statistically lower anxiety levels with the chanting intervention (Innes et al., 2016; Maziha et al., 2018; Nasiri et al., 2016) which suggests potential benefits of chanting to manage anxiety. **While some reduction in *depression* was noted in the three studies that evaluated this mental health outcome, statistically significant change was noted in only one study (Innes et al., 2016).** Similarly, only one study found statistically significant change in *stress* (Innes et al., 2016). **Thus, while evidence of chanting in depression and stress is encouraging, there is insufficient evidence to draw conclusions on the efficacy of chanting for these two outcomes.**

Our search strategy did not retrieve any study that considered sensorimotor chanting on PTSD. While there are some studies that show positive effects of silent chanting of a word or phrase (related to spiritual tradition) in PTSD (Bormann et al., 2014, Oman & Bormann, 2015), these studies lacked a sensorimotor component such as vocalisation and/or use of hand or finger movements so could not be included in this review. However, a previous review of the effects of chanting with and without sensorimotor components on mental health in non-clinical samples reported minimal to moderate benefits (Lynch et al., 2018); however the authors did not differentiate studies on the basis of silent versus sensorimotor R/S chanting. Findings reported by Perry (2017) suggest that the inclusion of sensorimotor components may enhance benefits since self-reported stress levels were found to be significantly reduced for vocal chanting

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compared to silent chanting. Though not specific to PTSD, our findings combined with those of the above two studies (Lynch et. al., 2018; Perry, 2017), suggest that the sensorimotor component of chanting practice may have additional benefits for mental health outcomes. This proposition is consistent with results of a recent survey (Perry et al., 2021) that reported more positive mood scale ratings for vocal chanting practices that included additional sensorimotor components, such as clapping and stepping, compared to chanting practice with no sensorimotor components (i.e., silent chanting).

4.2. Role of religion/spiritual affiliation

Understanding the role of R/S affiliation in the dissemination of sensorimotor R/S practices as a mental health intervention is important. While both breathwork and chanting were effective in the mental health outcomes considered, both these practices have their origin and affiliation within religious and/or spiritual traditions. This requires careful consideration if using these practices outside the context of these traditions. Although R/S affiliation was discussed by the authors of some included studies, none of the studies considered religious affiliations or spirituality as a variable in the study. As seen below, the extent to which studies relating to breathwork and chanting considered R/S affiliation, varied.

None of the studies that investigated *breathwork* required participants to be affiliated with a religion or a spiritual tradition. Findings of this review suggest, breathwork practice appears effective without this affiliation. It is possible that some participants had R/S affiliation which might have contributed to the efficacy but it is not possible to draw any conclusion in this regard as R/S affiliation was not measured in any study. A recent systematic review (Kuppusamy et al., 2018) of studies using yoga, **including practices that involve voluntary controlled breathing (i.e. pranayama),** also showed mental health benefits **but the intervention did not have a R/S component.** If a R/S affiliation is not required to benefit from breathwork practice, it may be used as an adjunct intervention in clinical settings. More

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focussed studies are required to understand the importance of R/S affiliation in getting mental health benefits from the breathwork.

For *chanting*, however, two of the four studies specified affiliation with the Islamic faith as a requirement in their inclusion criteria (Maziha et al., 2018; Nasiri et al., 2016). In one of these studies, familiarity with the relevant religious text (Al-Quran) and understanding of the meaning of verses (Maziha et al., 2018) was a condition to participate in the study. Moderate to strong faith and identification as a Shia Muslim was one of the inclusion criteria in the other study (Nasiri et al., 2016). Repetition of verses from familiar religious texts might have helped participants who were associated with that religion; however, there is no study in the extant literature that suggests whether familiarity and understanding of the meaning of the chanting verses add benefit to the practice. The remaining two studies that considered chanting did not require participants to have any affiliation with a religion/spiritual tradition or prior familiarity of the chanting verse used in the studies (Innes et al., 2016; Lavretsky et al., 2013) and still revealed reduced anxiety level with a significant change in one (Innes et al., 2016). Importantly, the authors of two studies (Innes et al., 2016; Lavretsky et al., 2013) cautioned using these practices with people with diverse religious and cultural backgrounds. Results of these two studies may not be applicable to a wider population, hence it is recommended that they only be applied with an understanding of the R/S background of individuals. Since none of the included studies in our review compared the effect of chanting with or without R/S affiliation, we can't say if R/S affiliation contributed to mental health outcome. In a recent survey though, faith based chanting practices scored higher in positive mood scale than the practices that were not associated with any belief system (Perry et al. 2021).

4.3. Potential application of breathwork and chanting in clinical settings

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In general, authors of included RCTs on *breathwork* reported high compliance among participants. Compliance was indicated via high attendance rate, completion of home practices/logs, willingness to participate in the intervention, and completion of outcome measures. Also, some authors identified breathwork as a cost-effective and feasible intervention in clinical settings (Bidgoli et al., 2016; Dhruva et al., 2012). Authors of two studies recommended expanding clinicians' skills through further training and/or hiring expert teachers to facilitate breathwork interventions in clinical settings (Bidgoli et al., 2016; Dhruva et al., 2012). Some authors proposed breathwork as an alternative for patients reluctant to take medications (Janakiramaiah et al., 2000; Sureka et al., 2014), while others proposed it as an adjunctive therapy (Bidgoli et al., 2016; Dhruva et al., 2012; Sendhilkumar et al., 2013; Sharma et al., 2017). Where pharmacological treatment is not an option (e.g., a patient reluctant to receive treatment or not responsive to antidepressants) sensorimotor R/S practice (breathwork) may be an alternative (Janakiramaiah et al., 2000; Sureka et al., 2014).

Breathwork intervention involved different combinations of breath holding and varying sequence of inhalation and exhalation which required participants to be at a cognitive level to comprehend and execute instructions. Most studies that used breathwork interventions excluded participants with cognitive deficits due to the cognitive requirement to understand and follow the breathwork practice correctly. This suggests that breathwork interventions might be more suitable for individuals with adequate cognitive level to understand and execute the instructions of breathing techniques. Another aspect to consider is the minimal physical requirement to practice breathwork. In their study of breathwork with people with physical illness, Sendhilkumar et al. (2013) suggested that, though effective in mental health outcomes, breathwork was potentially best suited for people who do not have physical limitations that may interfere with their ability to perform these physical practices (e.g.,

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hyperventilation and breath holding). This suggests that breathwork may be more applicable for people with reasonable physical fitness to perform breathing techniques.

While compliance among participants for *chanting* was not specified in studies, authors in two studies (Lavretsky et al., 2013; Nasiri et al., 2016) identified chanting/recitation as a valuable, non-pharmacological, and cost-effective intervention. Nasiri et al. (2016) further suggested the inclusion of religious care of patients as a low-cost, non-invasive intervention with no side effects. There was no mention of any adverse events in any of the four studies that investigated chanting/recitation as an intervention. As reported, chanting did not pose high cognitive and physical demands to participate in the practice; hence, it was suggested to be suitable for a wide population with varied physical and cognitive levels (Innes et al., 2016).

The findings of this systematic review suggest that it may be beneficial to use both breathwork and chanting to support mental health, particularly anxiety, in clinical and healthy populations. Breathwork (Bidgoli et al., 2016) and chanting (Nasiri et. al., 2017) were also effective interventions for anxiety for people undergoing surgeries; however, more studies are required to support their potential use in dealing with mental health concerns associated with surgeries.

For the effective translation of the empirical evidence in clinical settings, it is important to understand how feasible and applicable it will be to use breathwork and chanting in clinical settings. In a pseudo- randomised controlled trial, Simpson et al. (2021) assessed the effectiveness of vocal chanting as an online intervention. They reported that 10 minutes of online chanting led to a reduction in stress and an increase in positive affect (Simpson et al., 2021). These results support possible use of chanting as a mental health intervention. Further studies that assess the cost-benefit of breathwork and chanting interventions may support the applicability of these interventions in the clinical setting. More focussed investigations in the

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integration of breathwork and chanting in mainstream mental health intervention represent the next step for future research.

5. Limitations of the review and future considerations

This review included studies of the highest level of evidence; nevertheless, there are limitations in our systematic review that warrant consideration. In the protocol of the systematic review, we stated the intent was to investigate four sensorimotor R/S practices; however, our search strategy did not retrieve any RCTs on R/S singing and R/S movement. In view of this, another review has been conducted to examine the evidence of R/S singing and R/S movements without the restriction of study design (Malviya et al., 2021).

Our search strategy did not include non-English papers and grey literature, so some relevant research may have been overlooked. The review only included studies that used behavioral outcome measures and therefore excluded studies that measured mental health symptoms using physiological biomarkers. A meta-analysis was not able to be undertaken due to heterogeneity in the samples, intervention duration and intensity, and outcome measures.

The generalizability of our results is unclear due to a lack of information in some papers regarding participants' level of experience with R/S practices; it is not clear whether both novice and experienced users of each practice would experience similar benefits. Also, not all studies reported if the intervention was done individually or in a group so it remains unclear if format of the intervention might affect the effectiveness of R/S practices on mental health outcomes.

Recently there has been increasing emphasis on reporting the clinical significance of the research findings. Clinical significance refers to the extent a treatment effect size will impact in an actual clinical setting (Ranganathan et al., 2020). While all studies included statistical

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analysis, none of the studies in the review reported the clinical significance of the practices, which raises the question of reliability of transfer of the findings in clinical settings.

Despite these limitations, collective results of the 15 included studies suggest that sensorimotor R/S practices, specifically breathwork and chanting, can potentially be considered for therapeutic use in mental health settings. While a positive trend was noted on effectiveness of breathwork and chanting in stress, due to lack of number of RCTs, findings of the review should only be considered as indicative. More systematic investigations are warranted to assess the effectiveness of other sensorimotor R/S practices in mental health, particularly R/S movement and singing. Future investigations may examine evidence of objective measures such as biomarkers, physiological measures, and exploration of the mechanism of therapeutic effectiveness of sensorimotor R/S practices. For further application of findings of this review, more investigations are needed to assess the feasibility and applicability of R/S practices as mental health intervention in clinical settings. It is also important to explore the acceptability of sensorimotor R/S practice in people with diverse religious and/or spiritual background.

6. Conclusion

Findings suggest that the two sensorimotor R/S practices investigated in this review, breathwork and chanting, can potentially be considered as cost-effective, adjunctive interventions to support mental health. Though results were not robust enough to draw definitive conclusions, it appears that breathwork and chanting may reduce depression and anxiety. Sensorimotor R/S practices, such as chanting, may also be utilized for non-clinical mental health issues in healthy populations. For individuals going through potentially life-threatening surgeries and/or severe physical illness, sensorimotor R/S practices may be used as an adjunctive intervention to address associated mental health issues such as anxiety. Future investigations may consider other sensorimotor R/S

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practices that can be used as supplementary interventions to mainstream mental health interventions.

7. Authorship contribution statement

SM contributed to the protocol development, overall design, article screening, data collection, quality appraisal and manuscript preparation. PM and BZ contributed to overall design, screening of articles and review of the manuscript. LK contributed to data collection, quality appraisal and review of the manuscript.

8. Declaration of competing interest

None

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Supplementary Material

Search Strategies

Search Strategy for CINAHL, MEDLINE, PSYCHINFO AND ProQuest

DATABASE	CINAHL (from 1937 to 2019)
STRATEGY	#1 AND #2
1	Chant* OR Recitation OR Mantra OR Japa OR Dhikr OR Tasbih OR Cantillation OR "Singing Prayer" OR Hymn OR Choir OR Kirtan OR Piyyut OR "religious singing" OR "religious song" OR Breathwork OR "Breathing Meditation" OR "Breathing yoga" OR Breath yoga OR Pranayama OR "Breath meditation" OR Breath-work OR Dancing OR "Dynamic meditation" OR "Sacred dancing" OR "Religious Dancing" OR "Rhythmic movement" or Whirling
2	(MH "Depression+") OR (MH "Anxiety+") OR (MH "Stress+") OR (MH "Stress Disorders, Post-Traumatic+")
Limiters Applied	English language, Randomized Controlled Trial, Peer Reviewed.
DATABASE	PsycINFO (from 1600 – 2019)
STRATEGY	#1 AND #2 AND #3
1	Chant* OR Recitation OR Mantra OR Japa OR Dhikr OR Tasbih OR Cantillation OR "Singing Prayer" OR Hymn OR Choir OR Kirtan OR Piyyut OR "religious singing" OR "religious song" OR Breathwork OR "Breathing Meditation" OR "Breathing yoga" OR Breath yoga OR Pranayama OR "Breath meditation" OR Breath-work OR Dancing OR "Dynamic meditation" OR "Sacred dancing" OR "Religious Dancing" OR "Rhythmic movement" or Whirling
2	((((MM "Depression (Emotion)") OR (DE "Major Depression" OR DE "Anaclitic Depression" OR DE "Dysthymic Disorder" OR DE "Endogenous Depression" OR DE "Late Life Depression" OR DE "Postpartum Depression" OR DE "Reactive Depression" OR DE "Recurrent Depression" OR DE "Treatment Resistant Depression") OR) OR (DE "Anxiety" OR DE "Anxiety Sensitivity" OR DE "Computer Anxiety" OR DE "Health Anxiety" OR DE "Mathematics Anxiety" OR DE "Performance Anxiety" OR DE "Social Anxiety" OR DE "Speech Anxiety" OR DE "Test Anxiety" OR DE "Anxiety Disorders" OR DE "Castration Anxiety" OR DE "Death Anxiety" OR DE "Generalized Anxiety Disorder" OR DE "Obsessive Compulsive Disorder" OR DE "Panic Attack" OR DE "Panic Disorder" OR DE "Phobias" OR DE "Separation Anxiety Disorder" OR DE "Trichotillomania" OR DE "Anxiety Sensitivity") OR) OR (DE "Stress" OR DE "Academic Stress" OR DE "Caregiver Burden" OR DE "Chronic Stress" OR DE "Environmental Stress" OR DE "Financial Strain" OR DE "Minority Stress" OR DE "Occupational Stress" OR DE "Physiological Stress" OR DE "Post-Traumatic Stress" OR DE "Psychological Stress" OR DE "Social Stress" OR DE "Stress Reactions" OR DE "Stress and Coping Measures" OR DE "Stress and Trauma Related Disorders" OR DE "Acute Stress Disorder" OR DE "Adjustment Disorders"

	OR DE "Attachment Disorders" OR DE "Posttraumatic Stress Disorder" OR DE "Stress Management" OR DE "Stress Reactions" OR DE "Compassion Fatigue")) OR (DE "Posttraumatic Stress Disorder" OR DE "Complex PTSD" OR DE "DESNOS")
3	Randomized Controlled trial
Limiters Applied	English language, Peer Reviewed
DATABASE	MEDLINE
STRATEGY	#1 AND #2
1	Chant* OR Recitation OR Mantra OR Japa OR Dhikr OR Tasbih OR Cantillation OR “Singing Prayer” OR Hymn OR Choir OR Kirtan OR Piyyut OR “religious singing” OR “religious song” Breathwork OR “Breathing Meditation” OR “Breathing yoga” OR Breath yoga OR Pranayama OR “Breath meditation” OR Breath-work OR Dancing OR “Dynamic meditation” OR “Sacred dancing” OR “Religious Dancing” OR “Rhythmic movement” or Whirling
2	MESH.EXACT.EXPLODE("Depression") OR MESH.EXACT.EXPLODE("Anxiety") OR (MESH.EXACT("Stress Disorders, Traumatic, Acute") OR MESH.EXACT("Stress Disorders, Post-Traumatic") OR MESH.EXACT("Stress Disorders, Traumatic")) OR MESH.EXACT("Stress, Psychological")
Limiters Applied	English Language, Document Type - Randomized Controlled trial
DATABASE	PROQuest
STRATEGY	#1 AND #2 AND #3
1	Chant* OR Recitation OR Mantra OR Japa OR Dhikr OR Tasbih OR Cantillation OR “Singing Prayer” OR Hymn OR Choir OR Kirtan OR Piyyut OR “religious singing” OR “religious song” Breathwork OR “Breathing Meditation” OR “Breathing yoga” OR Breath yoga OR Pranayama OR “Breath meditation” OR Breath-work OR Dancing OR “Dynamic meditation” OR “Sacred dancing” OR “Religious Dancing” OR “Rhythmic movement” or Whirling
2	MESH.EXACT.EXPLODE("Depression") OR MESH.EXACT.EXPLODE("Anxiety") OR (MESH.EXACT("Stress Disorders, Traumatic, Acute") OR MESH.EXACT("Stress Disorders, Post-Traumatic") OR MESH.EXACT("Stress Disorders, Traumatic")) OR MESH.EXACT("Stress, Psychological")
3	Randomized Controlled Trial
Limiters Applied	English language