

# UNIVERSITY OF TWENTE.

## **Mindfulness Based Stress Reduction Treatment for Insomnia And Insomnia Symptoms**

### **- A Systematic Literature Review**

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## Abstract

CBT-I is currently the standard treatment for people suffering from insomnia but up to 25 % patients do not respond to the treatment or only experience partial symptom relief (Shallcross et al., 2019). Following from this, more research is needed into ways in which insomnia patients can receive treatment, which is complementary to cognitive behaviour therapy and not pharmacological in nature. Mindfulness-based-stress-reduction (MBSR) treatment “incorporates various types of meditation techniques and Hatha yoga postures” (Lamothe et al., 2016). This systematic review aimed to answer the research question of how effective MBSR treatments for insomnia and insomnia symptoms are, and what role attitudes towards this form of treatment play. We selected 11 studies based on our search through the databases Scopus, PubMed and Web of Science. We included randomised controlled trials investigating the effects of MBSR on sleep quality. Sample sizes within studies varied between 28 and 336 participants. Studies compared the MBSR treatment to waitlist, treatment as usual, CBT-I, acupuncture, athletic exercise, pharmacological and self-monitoring control conditions. In at least one sleep parameter, all of the 11 studies showed a significant difference in favour of the MBSR condition. The quality assessment of the 11 selected studies revealed a high probability for biases among the studies, especially detection and attrition biases. A strength of this systematic review was the strict eligibility criteria, and the main limitation was the high amount of possible bias. In conclusion, MBSR treatment for insomnia and insomnia symptoms seems to be a valuable addition to more traditional forms of treatment for insomnia.

## Introduction

Adequate sleep is one of the very essential universal functions of living species, to which we humans dedicate about one third of our life (Pavlova & Latreille, 2018). Unfortunately, research has demonstrated that more than half of the adult population in the USA suffers from sleep problems (56%); in Western Europe 31% of people suffer from sleeping problems, and in Japan approximately 23% of adults have problems getting enough quality sleep (Léger, Poursain, Neubauer & Uchiyama, 2008). These alarming numbers show that sleep problems are a problem that is spread across the globe, with the USA having exceptionally bad sleepers. In case of very severe sleep problems, which have a profound impact on the daily functioning of a person, insomnia can be diagnosed. Insomnia is diagnosed by difficulties initiating and maintaining sleep, or the experience of non-restorative sleep despite efforts to fall asleep (different to sleep deprivation). Since insomnia is both a symptom and a disorder in its own right, prevalence numbers are not so clear cut. One is diagnosed with the disorder of insomnia, as opposed to the symptom, if the complaints occur on at least 3 days per week, for at least 3 months, as manifested by the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013). Insomnia as a symptom is estimated at 30% prevalence, while insomnia as a disorder is found in 5-10% of the adult population (Roth, 2007). Insomnia comes with a lot of suffering for the people being diagnosed with the disorder (Taddei-Allen, 2020). Next to ruptures in the nocturnal domain, such as sleep disturbances and environmental sensitivity; people suffering from insomnia also have difficulties in their daytime domains, such as sleepiness and cognitive difficulties (Moul, et al., 2002). On top of these impacting consequences, insomnia has a high comorbidity rate making it a risk factor for medical problems as well as mental ones. A heightened medical risk for insomnia patients include heart disease, high blood pressure and neurologic disease (Taylor et al., 2006). Almost more alarming are possible psychological

consequences, with insomnia being comorbid with depression, with some strings of research even investigating the possibility of insomnia leading to depression (Taylor, 2008). Next to depression, insomnia also has a noticeable correlation with anxiety disorders and anxiety sensitivity, with trait anxiety being the highest predictor (Kim, Choi, Lim & Oh, 2006).

What becomes evident, is that an applicable treatment for insomnia patients would not only benefit those who suffer from the symptom and the disorder, but it would also cause an alleviation on the economic burden of insomnia (Daley, Morin, LeBlanc, Grégoire & Savard, 2009). Insomnia is associated with an increased use of health care services and products, as well as functional impairments (Daley, Morin, LeBlanc, Grégoire & Savard, 2009). For each person in the US suffering from insomnia, it is estimated that direct costs make up to \$1453 for 6 months, and \$1091 indirect costs (Botteman et al., 2007).

Unfortunately, pharmacological treatments for insomnia do not come without risks or side-effects (Ramakrishnan & Scheid, 2007). Pharmacological treatment for insomnia patients include the intake of benzodiazepines, which are helpful in the short-term, but can have severe adverse effects and might lead into dependency in the long-term (Morin et al., 2003). Non-benzodiazepines have fewer side-effects than benzodiazepines, but they have less of a significant effect on improved sleep quality than benzodiazepines (Huedo-Medina et al., 2012).

Melatonin is a safe alternative, but only recommended to use in the short-term (Ramakrishnan & Scheid, 2007). The most recommended treatment for insomnia, according to the European guideline for the diagnosis and treatment of insomnia, is cognitive behaviour therapy for insomnia (CBT-I) (Riemann et al., 2017). CBT-I is a collection of multiple interventions, which are directed at behavioural, cognitive, and physiological perpetuating factors of insomnia (Morin et al, 1994). Components of CBT-I include stimulus control therapy, sleep restriction, relaxation, and cognitive therapy (Morgenthaler et al., 2006).

Unfortunately, not all people suffering from insomnia have access to cognitive behaviour therapy or are not referred to it, especially in primary care (Koffel, Bramoweth & Ulmer, 2018). Even for insomnia patients who do receive CBT-I treatment, up to 25 % do not respond to the treatment or only experience partial symptom relief (Shallcross et al., 2019). Following from this, more research is needed into ways in which insomnia patients can receive treatment, which is complementary to cognitive behaviour therapy and not pharmacological in nature.

A very promising non-pharmacological alternative treatment for insomnia, which has gained attention in the last years, is mindfulness-based-stress-reduction (MBSR) treatment, or mindfulness-based therapy for insomnia (MBT-I) (Martires & Zeidler, 2015). MBSR works by the following working mechanisms: According to research, insomnia symptoms are caused by (1) rumination (Carney et al., 2010), (2) primary arousal (Harvey, 2002), (3) secondary arousal (how one relates to thoughts about sleep) (Ong et al., 2012), (4) selective attention/ sleep monitoring and effort (Harvey, 2002), and (5) distorted perceptions about sleep impairment (Harvey & Tang, 2012). Through mindfulness, experiential awareness is trained, which can have a reducing effect on all of the five aforementioned mechanisms. Further, mindfulness practises attention control, which has a beneficial effect on rumination, primary and secondary arousal and selective attention. Lastly, mindfulness teaches acceptance, which makes people less secondarily aroused, sleep is less monitored and distorted perceptions become less distorted (Shallcross et al., 2020).

The concept of mindfulness has been defined as “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 2009). MBTI is defined as treatment which “combines techniques and exercises drawn from CBT-I (cognitive behaviour therapy for insomnia) with mindfulness exercises, inquiry, and home practice” (Perini et al., 2021). MBSR are interventions which “incorporate various types of meditation

techniques and Hatha yoga postures” (Lamothe et al., 2016). Existing literature holds that a MBSR approach to insomnia is not only viable, but also could serve as an alternative to existing conventional treatments for insomnia (Ong et al., 2013). Research comparing the effectiveness of different treatments for people suffering from insomnia found CBT-I and MBSR to show comparable levels of effectiveness, with some studies even favouring MBSR over CBT-I (e.g. Garland et al., 2015).

Summarising the above, many people suffer from insomnia, and the first line of treatment is CBT-I (Riemann et al., 2017). MBSR as a complementary treatment to CBT-I show promising effects for the improvement of sleep (Ong et al., 2013). However, to date, a comprehensive review of the existing literature on MBSR for insomnia and insomnia symptoms, especially regarding effectiveness and the influence of attitudes towards MBSR of patients, is lacking.

Therefore, the first question this systematic literature review aims to find an answer to is how effective MBSR-based treatments are for people suffering from insomnia and insomnia symptoms (Ong & Smith, 2017). For this, we will look into existing literature to gather information on effectiveness on different forms of MBSR-based treatments of insomnia (Ong et al., 2018). Secondly, we will exploratively search for attitudes of insomnia patients when confronted with MBSR-based treatment (Ong & Scholtes, 2011). By this, we aim to find an answer to the question of how the feasibility of MBSR-treatment for insomnia can be improved (Kennett, Bei & Jackson, 2021).

## **Methods**

### **Search strategy**

To answer the two given research questions, this systematic literature review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA; Liberati et al., 2009). To find suitable studies to answer the two research

questions, the following databases were consulted: Scopus, PubMed, and Web of Science.

Refer to Appendix A for information on the search strings that were used.

### **Inclusion and Exclusion criteria**

For this systematic literature review, we only incorporated randomised controlled trials (RCTs), since RCTs evidently have high validities, due to their scientifically high-quality nature, making it the gold standard in behavioural sciences (Hariton & Locascio, 2018). Since we narrowed our research questions to focus on adults suffering from insomnia or sleep problems, all articles which studied an adolescent or children population were excluded. No difference was made between type and severity of insomnia. Six different pools of participants were included: 1) populations with transient insomnia, 2) studies examining short-term insomnia, 3) populations suffering from chronic insomnia, 4) studies in which no distinction between the three types of insomnia is made, 5) studies investigating two or all of the three subgroups or 6) populations with insomnia symptoms and no diagnosed insomnia. We chose not to focus exclusively on one of these three types of insomnia, since these types only differentiate in their duration (Roth & Roehrs, 2003).

The primary intervention of the included RCTs had to be MBSR. To be included for further analysis, the intervention or therapy must have been described in sufficient detail. Only studies, which adhered to the standardised MBSR treatment protocol were selected for this review. In this review, only articles published after 2001 were included, as the first valid assessment instrument to diagnose insomnia was published in 2001 (Insomnia Severity Index, ISI, Bastien, Vallières & Morin, 2000). Two types of treatment were included: Mindfulness-based therapy for insomnia (MBTI) and mindfulness-based stress reduction (MBSR). Studies with the care setting of nursing homes, day clinics and outpatient care were included for our analysis. We included studies comparing mindfulness-based stress reduction interventions to care-as-usual, WLC (waitlist-control), or other types of reference

interventions and treatments, such as CBT-I. We included studies, which measured sleep quality with at least one quantitative measurement.

Concerning the first research question, we looked at the overall effectiveness of MBSR-interventions for patients suffering from insomnia. Secondly, we exploratively looked into the attitudes insomnia patients have when being introduced to MBSR-interventions.

All data was extracted by an individual researcher independently. Only English papers were considered, to safeguard interpretability and study quality.

### **MBSR treatment**

The concept of mindfulness has been defined as “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 2009). MBTI is defined as treatment which “combines techniques and exercises drawn from CBT-I (cognitive behaviour therapy for insomnia) with mindfulness exercises, inquiry, and home practice” (Perini et al., 2021). MBSR are interventions which “incorporate various types of meditation techniques and Hatha yoga postures” (Lamothe et al., 2016). The standardised MBSR protocol includes weekly sessions of 2-2.5 hours and one whole day session after the sixth or seventh week. The weekly sessions include the following elements: 1) body-scan exercises, 2) mental exercises to focus one’s attention on the breath, 3) physical exercises, 4) being fully aware in everyday situations using the breath as an anchor for attention. In each session, there is room for the group to discuss and share what they experience when they engage in mindfulness. Between the sessions, it is highly recommended for the participants to practise further at home, for 30-40 minutes daily. The participants are provided with audio recordings to listen to at home. The group exist of 10-30 members and is led by one or two certified instructors (de Vibe et al., 2010).



## **Data extraction**

The following data was extracted by the researchers: first author, year of publication, sample size, country of research, demographic characteristics (e.g., gender, age), characteristics of sample, study design, MBSR treatment characteristics, sleep problems measure, and the most relevant findings.

## **Quality of Included Studies**

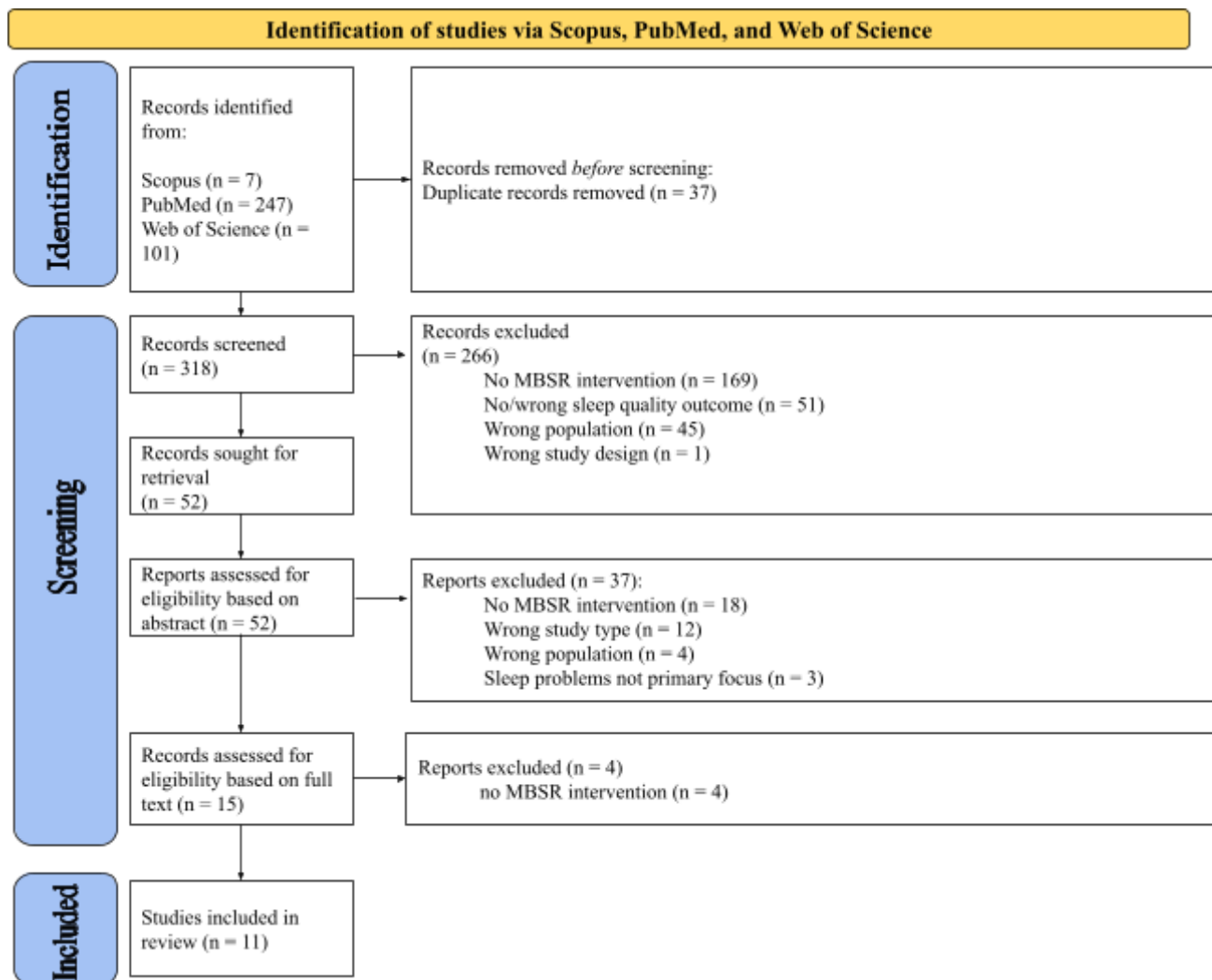
For each of the 11 studies, it was determined whether there was a low, a high, or an unclear risk of bias according to the Cochrane Collaboration's tool for assessing risk of bias in RCTs (Higgins et al., 2011): i.e. random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and selective reporting.

## **Results**

### **Results of Search**

The steps of this literature search and assessment can be found in *Figure 1*. In total, our search led to a total of 11 articles to be left for the analysis of this study. All of these 11 articles met the inclusion criteria as well as the exclusion criteria in terms of type of studies, age of participants, types of insomnia and insomnia and sleep problems as the main focus of study. All of the 11 studies focused on adult populations, all of the studies were conducted as RCTs, all studies included a randomised MBSR-intervention group and all studies measured sleep with a quantitative measurement. A detailed summary of the included articles can be found in *Table 1*.

Figure 1 PRISMA-Flow diagram



**Table 1.** Summary of main findings on MBSR treatment and insomnia symptoms

Study (first author, year)	N (MBSR group; controls, baseline)	Sample characteristics at baseline	Study design	MBSR treatment characteristics	Sleep problems measure	Relevant findings
Andersen (2013)	168 MBSR, 168 control (TAU)	Denmark, 100% female, <i>M</i> age = 54.15, other characteristics: breast cancer	RCT	standardized MBSR treatment, psychoeducation, meditation and gentle yoga (8 weekly sessions, 2 hours per session)	MOS Sleep Scale, 12 items, 6-point scale	Small statistically significant effects were found in the MBSR condition compared to the TAS control group, with sleep disturbances being reduced at post-intervention (Cohen's <i>d</i> = .24). At 12 months follow-up, no significant between-group effect was found.
Barrett (2020)	137 exercise, 138 MBSR, 138 control (WL)	USA, 75.8% female, <i>M</i> age = 49.46	secondary analysis of RCT	training in standard MBSR format, weekly class for 8 weeks (2.5 hours per class)	PSQI, 19 items; 7- point scale	Compared to the WL control condition, PSQI global score improved modestly for the MBSR group ( <i>p</i> = 0.07) and significantly for the exercise group ( <i>p</i> = 0.0006). Sleep efficiency did not significantly differ for the MBSR group after the intervention. At 7 months follow-up, both groups sustained their improved sleep quality significantly (MBSR: <i>p</i> = 0.01; exercise: <i>p</i> = 0.001).
Gallegos (2018)	100 MBSR, 100 control (WL)	USA, 62% female, <i>M</i> age = 72.5, other characteristics: older adults	secondary analysis from a randomized trial	group-based curriculum (15-20 members). MBSR treatment groups led by certified instructor. (8 weeks, weekly 120-minutes session, one 7 hour session).	PSQI, 19 items; 7- point scale	Participants with a baseline score of > 5 (sleep disturbance) improved their sleep with a small-sized significant effect after the intervention compared to the WL control group ( <i>p</i> = 0.02). Participants with a baseline score of ≥10 (insomnia), showed a medium-sized significant effect after the intervention compared to the WL control condition ( <i>p</i> = 0.04).
Garland (2014)	47 CBT-I, 64 MBSR	Canada, 72% female, <i>M</i> age = 58.89, other characteristics: insomnia comorbid with cancer	randomized, partially blinded, noninferiority trial	MBSR delivered in groups (15-20), psychoeducation on the relationship between stress and health, yoga and meditation. (8 weeks, weekly 90-minute sessions plus one 6 hour intensive silent retreat).	ISI, 7 items; 5-point scale; PSQI, 19 items; 7- point scale; DBAS-16; Actigraphy; Sleep diary	After the treatment, the CBT-I group did not significantly differ from the MBSR group on the ISI ( <i>p</i> = 0.39). At 5 months follow-up, the two groups showed a significant difference between each other, with the CBT-I group having improved sleep significantly ( <i>p</i> = 0.01). After the treatment, the two groups differed significantly on PSQI scores, with CBT-I showing a higher sleep quality ( <i>p</i> = 0.01). A significant group difference was also found on the DBAS-16 ( <i>p</i> = 0.01) after the intervention with CBT-I showing improved sleep quality. After the intervention, the actigraphy scores differed between the groups in SOL ( <i>p</i> = 0.003) and TST ( <i>p</i> = 0.04), favouring the CBT-I group.
	19 MBSR,	USA, 72.5% female, <i>M</i> age =	pilot randomized	meditative techniques: body scan, standing, sitting and	Sleep-diary; Wrist actigraphy and	Actigraphy measurements on SOL showed a significant improvement in the MBSR group post-intervention ( <i>p</i> < 0.05). Significantly large improvements were found on the ISI,

Gross (2011)	9 PCT	50.25, other characteristics: primary chronic insomnia	controlled clinical trial	walking meditations, and gentle Hatha yoga. (8 weekly, 2.5 hour classes and one 6-hour day-long retreat).	self-report questionnaires: ISI, 7 items; 5-point scale; PSQI, 19 items; 7- point scale; SSES, 9 items; 11-point scale; DBAS-16, 16 items; 10-point scale	PSQI, and diary measurements in the MBSR group compared to the PCT group ( $p < 0.01$ , all) at 5 months follow-up.
Jones (2020)	15 MBSR, 12 control (athletic training program alone)	USA, 100% female, $M$ age = 21.5, other characteristics: female collegiate rowers	controlled experimental design	MBSR course: 8 classes occurring over a 9-week period, each session lasting 75 minutes, led by a professional instructor. No day-long silent retreat. Guided meditations and discussions. handouts, workbooks, audio recordings, minimum of 10 minutes of additional mindfulness practice prior to sleep.	Actigraphy; PSQI, 19 items; 7- point scale	Pittsburgh Sleep Quality Index (PSQI) scores non-significantly decreased (improved) in the MBSR group ( $p = 0.047$ , did not survive Bonferroni correction), and non-significantly increased in the athletic training program control group ( $p = 0.046$ , did not survive Bonferroni correction). Actigraphy outcomes for SE significantly improved for the MBSR group compared to the control group ( $p = 0.024$ ), all other changes were not significant.
Lengacher (2015)	28 MBSR, 41 control (TAU & WL)	USA, 100% female, $M$ age = 57.0, other characteristics: women with breast cancer	RCT	stress reduction and symptom management through: relaxation, meditation, mind-body connection and healthy lifestyles, yoga, body scan, walking meditation, group interaction and discussion. (six weeks, 2 hour weekly sessions and 15-45 minutes per day practice of meditation techniques).	Actigraphy; Sleep diary; PSQI, 19 items; 7-point scale	A significant effect was found in the MBSR group on sleep improvement after 12 weeks on sleep efficiency ( $p = 0.04$ ) compared to the control group. Another significant improvement was found in the MBSR group compared to the control group on percent of sleep time ( $p = 0.02$ ). A significant improvement in favour of the MBSR group compared to the control group was found in terms of less number waking bouts ( $p < 0.01$ ).
Liu (2022)	38 MBSR,	China, 98.64% female, $M$ age =	RCT	MBSR practice for 45 minutes daily, for eight	PSQI, 19 items; 7-point scale;	Significant improvements of sleep quality were measured for the MBSR group compared to the acupuncture and the control group on the PSQI scores ( $p < 0.001$ ) as well as on four

	36 acupressure, 34 control (TAU), 39 combined	51.41, other characteristics: breast cancer patients with insomnia undergoing chemotherapy		weeks, breath awareness, seated mindfulness meditation, focusing on one thing, body scanning, compassionate meditation, sounds and thoughts, choiceless awareness, coming full circle.	Wrist actigraphy	parameters measured with the actigraphy: SE, SL, TST & WASO ( $p < 0.05$ , all).
Ong (2023)	19 MBSR, 18 MBTI (mindfulness-based therapy for insomnia), 16 self-monitoring	USA, 74.1% female, $M$ age = 42.9, other characteristics: chronic insomnia	RCT	meditation practice: breathing, meditation, body scan, walking meditations, Hatha Yoga. Discussions and instructions for daily MBSR practice. (8 weeks, 2.5 hours each meeting, one 6-hour retreat).	Sleep diary; ISI, 7 items; 5-point scale	Post-intervention and at follow-up, MBTI had significantly greater reductions in ISI scores than the MBSR group ( $p < 0.05$ , all). Compared to SM, MBSR showed a significant reduction in sleep problems after the intervention ( $p < 0.05$ ).
Sadehgi-Bahmani (2022)	26 ACT, 25 MBSR, 25 control (WL)	USA, 81.49% female, $M$ age = 38.74, other characteristics: individuals with multiple sclerosis	RCT	manualized behavioural intervention: 3 groups led by one instructor. Mindfulness practice and training, mindful awareness of dynamic yoga postures, mindfulness during stressful situations and social interactions (8 weeks, 90-120 minutes per group session).	ISI, 7 items; 5-point scale	After the intervention, both the MBSR group and the ACT group significantly decreased symptoms of insomnia ( $p < 0.05$ ).
Zhang (2015)	30 MBSR, 30 control (WL)	China, 41.67% female, $M$ age = 78.1, other characteristics: chronic insomnia in older adults	RCT (single-blind)	body scan, standing, sitting, and walking meditations, two-hour silent retreat. Home practice expectations for 45 minutes per day. (eight weeks, two hour classes, half-day retreat).	PSQI, 19 items; 7-point scale	Significant decrease of PSQI score in the MBSR group compared to the WL control group after the intervention ( $p = 0.006$ ).

*Note.* DBAS-16 = Dysfunctional Beliefs About Sleep (Morin et al., 2007); ISI = Insomnia Severity Index (Bastien et al., 2001); MOS = Medical Outcomes Study (Hays et al., 2004); PCT = Pharmacological Treatment; PSQI = Pittsburgh Sleep Quality Index (Buysse et al., 1989); SSES = Sleep Self-Efficacy Scale (Lacks, 1987); TAU = Treatment as Usual; WL = Waitlist

### **Study Characteristics**

The studies displayed in *Table 1* studied the effects of a MBSR/ MBTI program on the insomnia symptoms of participants. The sample sizes of the included studies varied from 28 to 336. Five of the 11 eleven studies analysed people with diagnosed chronic insomnia (45%) (Garland et al., 2014; Gross et al., 2011; Liu et al., 2022; Ong et al., 2023; Zhang et al., 2015), whereas the other six studies analysed the sleep of non-insomnia-diagnosed patients (55%) (Andersen et al., 2013; Barrett et al., 2020; Gallegos et al., 2018; Jones et al., 2020; Lengacher et al., 2015; Sadeghi-Bahmani et al., 2022). In only one of the 11 studies, less females participated in the research compared to males (9%) (Zhang et al., 2015). In three studies only females took part (27%) (Andersen et al., 2013; Jones et al., 2020; Lengacher et al., 2015). Two studies studied women with breast cancer (18%) (Andersen et al., 2013; Lengacher et al., 2015). Two studies analysed samples of people diagnosed with different forms of cancer (18%) (Garland et al., 2014; Liu et al., 2022). One study looked at MBSR treatment for people suffering from multiple sclerosis (9%) (Sadeghi-Bahmani et al., 2022). Two studies explicitly studied effects of MBSR treatment for insomnia in older adults (18%) (Gallegos et al., 2018; Zhang et al., 2015). Two studies analysed healthy populations (18%) (Jones et al., 2020; Barrett et al., 2020), one specifically focused on female collegiate rowers (9%) (Jones et al., 2020).

Overall, one study was conducted in Europe (9%) (Andersen et al., 2013), seven studies were conducted in the United States of America (64%) (Barrett et al., 2020, Gallegos

et al., 2018; Gross et al., 2011; Jones et al., 2020; Lengacher et al., 2015; Ong et al., 2013; Sageghi-Bahmani, 2022), one study was conducted in Canada (9%) (Garland et al., 2014) and two studies were conducted in China (18%) (Liu et al., 2022; Zhang et al., 2015). All studies used a parallel RCT design (91%), except for one study (Liu et al., 2022) in which a factorial RCT study was used. In a factorial RCT design for a study with two conditions, participants are either randomised to one intervention, to another intervention, to no intervention, or to both interventions (Montgomery, Peters & Little, 2003).

### Quality Assessment

In this review, we analysed all RCTs using the Cochrane collaboration tool (Higgins et al., 2011) to estimate the risk of bias. A detailed overview of the results of the risk of bias assessment can be found in *Table 2*. Overall, the quality in the field of studies focussing on MBSR treatment for people with insomnia symptoms is satisfactory in terms of low selection bias probabilities, but overall the studies have relatively high likelihood for attrition and detection biases. In a similar meta-analysis, selection bias, performance bias and detection bias were unclear to determine, reporting bias showed a high risk (Zhang, Zhao & Zheng, 2018). As can be seen in other reviews on MBSR treatments, the quality of studies in this field often vary considerably, and a high risk of bias is not uncommon (de Vibe et al., 2010).

**Table 2.** *Quality Assessment of Selected Studies*

	Selection Bias		Performance Bias	Detection Bias	Attrition Bias	Reporting Bias	Other Bias
Author	RSG	AC	BPP	BOA	IOD	SR	
Andersen (2013)	+	+	-	<b>X</b>	+	+	-

	Selection Bias		Performance Bias	Detection Bias	Attrition Bias	Reporting Bias	Other Bias
Barrett (2020)	+	+	-	X	+	X	-
Gallegos (2018)	+	+	+	X	X	+	-
Garland (2014)	+	+	+	X	X	+	-
Gross (2011)	+	X	X	X	X	+	-
Jones (2020)	X	+	X	X	X	+	-
Lengacher (2015)	+	+	-	X	+	+	-
Lui (2022)	+	+	X	+	X	+	-
Ong (2023)	X	+	+	X	X	+	-
Sadeghi-Bahmani (2022)	+	+	+	+	+	+	-
Zhang (2015)	+	X	X	X	+	+	-

*Note.* + = low; - = some concerns; X = high; AC = Allocation Concealment; BPP = Blinding of Participants and Personnel; BOA = Blinding of Outcome Assessment; H = High Risk of Bias; IOD = Incomplete Outcome Data; L = Low Risk of Bias; RSG = Random Sequence Generation; SR = Selective Reporting; - = Unclear

### **How effective are MBSR treatments for people suffering from insomnia?**

All of the 11 studies measured insomnia and insomnia symptoms with at least one sleep quality questionnaire. The most often used questionnaire was the Pittsburgh Sleep Quality Index, short PSQI (Buysse et al., 1989), which is an 19-item questionnaire measuring



sleep disturbance on seven dimensions: Subjective sleep quality, sleep latency, sleep duration, habitual sleep efficacy, sleep disturbances, sleep medication, daytime functioning (Buysse et al., 1989). The PSQI shows high internal consistency with a Cronbach's alpha value of 0.83 (Buysse et al., 1989). Five of the studies used follow-up measurements, which were on average 4.8 ( $SD = 1.1$ ) months after the post-evaluation. PSQI scores increased significantly 8 weeks after the MBSR condition in six of the eight studies. At follow-up, four of the five studies examining follow-up effects found significant long-term effects of MBSR treatment for PSQI scores.

The second most used mean to measure insomnia symptoms was a wrist actigraphy. Wrist actigraphies are a tool to be worn on the wrist during sleep to measure sleep movements (Martin & Hakim, 2011). These movements provide data to analyse sleep parameters such as TST (total sleep time), sleep efficiency (SE) and wake after sleep onset (WASO) (Blackwell et al., 2008). Three of the studies using an actigraphy measurement to measure insomnia symptoms found a significant decrease on wake after sleep onset in the MBSR condition. Two studies found a significant improvement on the total sleep time parameter in the MBSR condition. One study showed a significant improvement in sleep efficacy for the MBSR condition group.

Four of the studies measured insomnia symptoms with the Insomnia Severity Index (ISI) (Bastien et al., 2001). The ISI is a seven-items-self-report questionnaire measuring the severity of insomnia symptoms. The seven items cover the following subjective measurements: severity of initial sleep-onset, sleep maintenance, early morning awakening, the satisfaction of the current sleep routine, interference with daily functioning, noticeability of impairment attributed to sleep problems, level of distress caused by the sleep problem, in the last two weeks (Bastien, Vallières & Morin, 2001). All of the four studies examining insomnia symptoms with the ISI found a significantly lower total score 8 weeks after

baseline, and all four studies found a significant difference still at follow-up.

Two studies used the Dysfunctional Beliefs and Attitudes about Sleep (DBAS-16) to measure insomnia severity (Garland et al., 2014; Gross et al., 2011). The DBAS-16 is a 30-item self report questionnaire to measure sleep-related cognition, for instance faulty beliefs and appraisals, unrealistic expectations, and perceptual as well as attentional bias, which are important cognitions in the perpetuity of sleep problems in insomnia (Morin, Vallières & Ivers, 2007). Both of the two studies showed a significant improvement of the DBAS-16 overall score, both 8 weeks after baseline, as well as at follow-up.

One study used the Medical Outcome Scale Sleep Scale (MOS-SS) (Hays et al., 2005) to measure sleep quality (Andersen et al., 2013). The MOS-SS is a 12-item self-report sleep scale with six subscales. The sub-scales measure the following sleep parameters: Sleep disturbance, sleep adequacy, daytime somnolence, snoring, awaken short of breath or with a headache and quantity of sleep (Hays et al., 2005). The only significant effect observed was in somnolence (daytime sleepiness), which was observed at 8 weeks after baseline, but no longer at 12-month follow up.

Summarising these results described above, in all of the 11 included studies, MBSR appears to have a positive effect on sleep parameters, with improved sleep found in 11 of the 11 studies post-intervention. For 3 studies, this effect was not observed at follow-up and 4 of the 11 selected studies did not include a follow-up measurement. However, in the one study with a direct comparison, CBTI appeared to be more effective. Nevertheless, it can be summarised that MBSR treatment has high scientific evidence for its effectiveness for sleep problems. It appears to be especially effective for people suffering from insomnia of older age.

#### **Attitudes of insomnia patients when confronted with MBSR-based treatment**

None of the 11 selected studies incorporated a subjective or objective measurement on participant's perception and attitudes towards MBSR treatment. We can only make inferences based on the unsystematic descriptions of the authors.

In the study by Liu et al. (2022), the percentage of people refusing to participate was higher than expected (37.76%). In the MBSR group, the drop-out rate was relatively high, with 26.32% of participants leaving the study prior to its ending. More than half of the participants in the MBSR group (64.29%) had a primary-school education or below, which is what the researchers take as a possible explanation for the high drop-out rates. Another interesting fact is that drop-out participants in the MBSR group were significantly younger than the remaining participants. The drop-out patients also showed less fatigue, less depression and anxiety, less WASO, and less MWBT at baseline. The study by Liu et al., showed a significant effect of MBSR treatment on the quality of sleep in cancer patients (2022).

In the study by Andersen et al. (2013), cancer participants voluntarily self-selected to take part in the MBSR study. People who took part in the study as opposed to those who refused to take part were on average younger, had a less recent cancer-diagnosis and had a higher level of education (Andersen et al., 2013). This result gives room to make inferences about the impact attitudes about MBSR can play on its effectiveness on sleep quality. It seems that, according to the study by Andersen et al. (2013) younger patients are not only more open to try out MBSR as a treatment for their sleep problems, but educated people also seem to have a better image of MBSR treatment (2013).

Garland and colleagues compared a MBSR treatment condition with a CBT-I condition for sleep quality in cancer patients (2014) and found no significant difference between the two conditions directly after the treatment, but CBT-I seemed superior to MBSR at 5 months follow-up. The researchers hypothesised that participants not already performing

yoga and meditation might find it less obvious to engage in a MBSR treatment for sleep improvement. Further, 27 potential participants were excluded from the study, because they already had taken an MBSR program, thus participants who had a positive attitude towards mindfulness and MBSR treatments were not enrolled (Garland et al., 2014).

The study by Gross and colleagues (2011), compared a MBSR treatment group with a pharmacotherapy treatment group for improving insomnia symptoms in people with chronic insomnia and found favourable effects for MBSR treatment, which were comparable to those of the pharmacotherapy group. After the intervention phase, participants were asked about their preferred choice of treatment with the MBSR treatment having gained more preference among participants (Gross et al., 2011). The researchers conclude that MBSR treatments may be more desirable and preferred for some patients of insomnia compared to more conventional forms of treatment for insomnia (Gross et al., 2011).

All in all, the explorative research question about the role of attitudes towards MBSR treatment, could not be answered completely satisfactorily in this review. On the one hand, the study by Liu et al. (2022) claims that young people are less likely to be open to MBSR treatments, whereas the study by Andersen et al. (2013) concludes that young patients are more open to these kinds of treatments. What Andersen et al. (2013) and Liu et al. (2022) seem to agree upon is that higher educated individuals are more likely to be open to MBSR treatments. Further, a positive attitude towards MBSR is likely to be beneficial for its effectiveness, as can be inferred from the study by Garland et al. (2014) and Gross et al. (2011).

## **Discussion**

The aim of this systematic review was to give an overview on the effectiveness of MBSR treatment for the treatment of insomnia and insomnia symptoms. The following two research questions were attempted to be answered in this systematic literature review: 1) How

effective are MBSR based treatments for people suffering from insomnia or insomnia symptoms? and 2) What role do attitudes towards MBSR treatments play in the effectiveness of MBSR treatments for people suffering from insomnia or insomnia symptoms?

For all of the 11 studies, MBSR treatment for sleep problems showed significant improvements on at least one sleep parameter. At follow-up, four studies showed that the positive effects of the MBSR treatment were maintained, three studies found no significant improvements of insomnia symptoms at follow-up, and the remaining four studies did not include follow-up measurements. This indicates that overall, research shows good effectiveness of MBSR based interventions for the treatment of insomnia.

Concerning the second research question, no definite conclusion can be drawn. No study included a measurement of MBSR treatment attitudes. Inferences could only be drawn from drop-out rates and characteristics of people dropping out of the MBSR treatment. This analysis yielded mixed results in terms of age of participants. Authors of the studies appeared to agree that more educated individuals seem to be more open to MBSR treatment to improve their sleep.

Following our review, it appears that MBSR is an effective treatment to improve sleep in people suffering from insomnia and sleep problems. These favourable effects seem to be relatively stable, even in the long term. Not only did MBSR treatment manage to compete against wait-list control conditions, but also against treatment as usual, and other active control conditions. However, compared with a CBT-I condition, the CBT-I group showed higher improvement of sleep compared to the MBSR group.

Despite the unquestionably positive effects in favour of the MBSR treatment for insomnia symptoms improvement, these findings are only partly in accordance with previous findings of similar reviews and meta-analysis. One meta-analysis on mindfulness meditation for insomnia showed more mixed results: According to the researchers, mindfulness seems to

have a significant sleep-improving effect on wake time and sleep quality, but not on sleep onset latency, total sleep time, wake after sleep onset, sleep efficacy and total wake time (Gong et al., 2016).

A systematic review on MBSR for sleep disturbance found only 4 of the 38 included studies to show significant results in favour of MBSR treatment for improvement of sleep compared to pharmacotherapy (Winbush, Gross & Kreitzer, 2007). Another meta-analysis about mindfulness meditation and sleep quality concluded mindfulness to not have a significant effect on sleep quality compared to active controls (Rusch et al., 2019). What this shows is that the effectiveness of mindfulness-based treatment for insomnia and insomnia symptoms is not fully established yet. More research needs to be done to investigate further on what factors make MBSR treatment effective. A possible reason for the contradicting results are different cultural backgrounds as well as different populations investigated.

Regarding the quality of the included studies in this review, the selected 11 studies give room to suspect multiple risks of biases. Firstly, it becomes evident that the selected studies are significantly female-oriented. Only one of the studies included more male participants than females, and three studies included only female participants. This could be due to more females suffering from insomnia (Krystal, 2003), but this could also be relevant for the external validity of this review, as former studies have shown that although females and males report similar improvements in stress reduction and cognitive reappraisal after a MBSR course, men improve significantly more on emotion suppression (Brown et al., 2020). Other studies, however, report females having significantly improved in mental distress, study stress, subjective wellbeing and mindfulness after a MBSR treatment, while the male participants did not show such effects (de Vibe et al., 2013). A study by Upchurch et al. studied the effects of gender on mindfulness practice and found women to practise more mindfulness-related practice overall. They found that 10.3% of women as compared to 5.2%

of men have practised meditation in the last year. Not only did they find that women practise more mindfulness than men, they also found specific gender differences in the way of practising mindfulness. They found that women were more often practising yoga, tai chi or qi gong and men were more likely to practise stand-alone mindfulness-exercises (2019). In this review, the one study with more males than females in the sample showed a significant outcome for the MBSR group as compared to the control group (Zhang et al., 2015). The three studies with only female participants showed mixed results. One study showed a significant positive effect after the intervention, but not for the follow-up measurement (Andersen et al., 2013); another study showed no significant improvement after the intervention in the MBSR group, except for SE actigraphy scores (Jones et al., 2020) and one study showed significant results for the actigraphy measurements after the intervention, but no significant improvement for the PSQI scores (Lengacher et al., 2015). This gives room to advise future systematic reviews about the effectiveness of MBSR treatments to include a sleep analysis about the effects of gender on effectiveness of these treatments.

Another characteristic of the studies included in this review, is a high mean age among participants across the studies. Two studies focussed explicitly on older adults (Gallegos et al., 2018 & Zhang et al., 2015). Only one study focused on young people between the ages of 18-23 (Jones et al., 2020). This could potentially bias the results, as multiple research studies have shown that older age can serve as a facilitator for MBSR treatment to increase its effectiveness (e.g. Gallegos et al., 2013). In our review, the studies focussing only on older adults, both showed a significant increase in insomnia symptoms after the MBSR intervention (Gallegos et al., 2018 & Zhang et al., 2015). The study focusing on young people, found significant results in favour of the MBSR treatment too (Jones et al., 2020). This implies that future studies would be advised to investigate the role of age in the treatment of insomnia symptoms with MBSR treatments.

Another characteristic in the selected studies was the high number of studies being conducted in the USA. Out of the 11 selected studies, seven were conducted in the USA. Only one study was conducted in Europe (Denmark) and two in Asia (China). This overrepresentation of American research in this review could give a biased representation of results. Cross-cultural differences in terms of mindfulness practice have been demonstrated in multiple studies (e.g. Olivera-Figueroa et al., 2022). Olivera-Gigueroa and colleagues compared the role of mindfulness and life-satisfaction in four different nations, and found the USA to show the highest life satisfaction, which was significantly correlated to their scores on mindfulness (2022). The reason for this high degree of mindfulness scores in the American sample could be the fact that mindfulness in America is commonly being practised in schools, universities, hospitals and the military (Ryan, 2012). Following from this, more research is needed to investigate the concrete relationship of culture and country of origin on mindfulness.

### **Limitations**

One major limitation of this study is the high probability of bias in the studies. Although a thorough risk assessment was conducted, quality of studies as well as risk of biases was not part of the inclusion and exclusion criteria. Future studies conducting a similar review might make sure in an earlier step of the review to exclude research with high risk of bias.

Another major limitation of this review is the fact that the explorative variable of attitudes was not part of the search strings. Future studies might put their focus more on the second research question and therefore get a clearer picture of the influence that attitudes play in the effectiveness of MBSR treatment for insomnia.

In this review, only one article investigated the difference in effectiveness of CBT-I treatment for insomnia and MBSR treatment and found no significant difference right after



the intervention, but at follow-up, in which CBT-I outperformed MBSR. One systematic literature review compared the effectiveness of CBT for insomnia with mindfulness as a treatment for insomnia. What they found was that mindfulness and yoga interventions showed more inconsistency, with some studies finding more significant results, some studies finding only insignificant trends towards improvements and some studies finding no results at all. CBT-I, on the other hand, showed more consistent results in favour of the treatment (Zeichner et al., 2017). This could explain why this review showed different outcomes than other meta-analyses and reviews of its kind.

All in all, this review demonstrates that MBSR treatment can serve as a valuable alternative to more traditional forms of treatment for people suffering from insomnia. In all of the studies used in this review, MBSR treatment was able to show significant changes in favour of sleep quality, compared to active and passive control groups. Concerning the second question, which assessed the role of attitudes in the treatment of insomnia via MBSR treatments, no concrete conclusion can be drawn. Studies show mixed results in this regard, with the only agreement being that researchers in multiple studies found more educated individuals to be more open for MBSR treatment to improve their sleep.

## **Conclusion**

Despite the limitations of this paper, this systematic review is the first one to summarise the findings of randomised controlled trials investigating the effects of MBSR treatment on insomnia and insomnia symptoms. These outcomes add a valuable part to the existing literature on alternative treatments for improving sleep and insomnia symptoms. We found that MBSR treatment for insomnia can serve as a valuable alternative to CBT-I, and that attitudes about this form of treatment seem to influence outcomes second-hand.

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## **Appendix A. Search strings.**

### *Search string SCOPUS*

MBSR OR “MBSR intervention” AND “sleep quality” OR "insomnia" AND RCT

### *Search string PubMed*

MBSR OR "MBSR intervention" AND "sleep quality" OR "insomnia" AND RCT

### *Search string Web of Science*

(MBSR OR “MBSR intervention”) AND (“sleep quality” OR “insomnia symptoms” OR “insomnia patients” OR insomnia)



