

A Review: Effectivity of Mindfulness Based Treatments for Insomnia

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Abstract

The aim of this systematic review is to explore the efficacy of mindfulness based treatments (MBTs) in treating insomnia. In this review, qualitative, quantitative and indirect evidence was discussed while exploring the efficacy of MBTs. Most papers suggest that MBTs somewhat improve the sleep onset latency (SOL), sleep quality, total sleep time (TST), wake up after sleep onset (WASO) and sleep efficiency (SE) in a variety of clinical populations. However, MBTs are not always found superior to immediately improve these sleep parameters when compared to cognitive-behavioral therapy. Yet, MBTs are shown to be similar effectiveness compared to other evidence based treatments in the long term. Thus, it can be concluded that MBTs are effective in improving sleep parameters as an auxiliary or second-line treatment. Further, MBTs decrease cognitive and emotional hyperarousal which can alleviate insomnia. This is seen as an indirect link explaining how MBTs can decrease insomnia symptoms.

Keywords: Sleep initiation and maintenance disorders, mindfulness, sleep wake disorders

Öz

İnceleme: Uykusuzluk Tedavisinde Farkındalık Temelli Tedaviler

Bu sistematik değerlendirmenin amacı, uykusuzluğun tedavisinde farkındalık temelli tedavilerin (FTT) etkisini araştırmaktır. Bu değerlendirmede, FTT'lerin etkinliği araştırılırken nitel, nicel ve dolaylı kanıtlar tartışılmıştır. Çoğu makale, çeşitli klinik popülasyonlarda FTT'lerin uyku başlangıcı gecikmesini (SOL), uyku kalitesini, toplam uyku süresini (TST), uyku başlangıcından sonra uyanma (WASO) ve uyku verimliliğini (SE) etkin bir şekilde iyileştirdiğini göstermektedir. Bununla birlikte, FTT' uygulamaları bilişsel davranışçı terapiye kıyasla bu uyku parametrelerini hızlı biçimde düzeltme konusunda üstün bulunmamaktadır. Uzun dönemde FTT'lerin diğer kanıta dayalı tedavilere benzer bir etkinlik gösterdiği ortaya çıkmaktadır. Bu nedenle FTT'lerin yardımcı veya ikinci basamak tedavi olarak uyku parametrelerinin iyileştirilmesinde etkili olduğu sonucuna varılabilir. Ayrıca FTT'ler, uykusuzluğu azaltabilen bilişsel ve duygusal aşırı uyarılmayı azaltır. Bu durum, FTT'lerin uykusuzluk semptomlarını azaltabileceğini açıklayan dolaylı bir bağlantı olarak görülmektedir.

Anahtar Kelimeler: Uyku başlatma ve sürdürme bozuklukları, bilinçli farkındalık, uyku uyanıklık bozuklukları

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INTRODUCTION

Sleep is a delicate, fundamental need with complex causes and effects (Reynolds & Cone, 2018). Not only does sleep get affected by our thought processes and negative mood; but it is also vulnerable to the temperature and the light quality of the room (Carney et al., 2005). Studies have shown that disruption to sleep decreases sleep quality. Insomnia is a complex disorder of chronic sleep disruptions. The prevalence of insomnia

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in adolescents reported to be as high as 23.8% (Hysing M. et al). Prevalence of insomnia in general population differs from study to study according to diagnostic criteria applied. In a study held in Poland reported %50,5 of adults self-reported sleep complaints (Nowicki et al, 2018). In another meta-analytic study in China with a participant number of 115.988, the prevalence of insomnia in general population was reported to be %15 (Cao et al, 2017).

On top of restless, sleepless nights, daytime is not pardoned for insomniacs; depressed mood, irritability, low productivity, reduced cognitive abilities, and fatigue are frequently reported (Ong et al., 2018). These daytime symptoms influence interpersonal, (Harvey, 2002) and occupational areas of life, causing further complications (Gong et al., 2016). The majority of insomnia cases co-occur with mood disorders like depression (Carney et al., 2005).

%17 to %50 of subjects who experienced insomnia longer than two weeks develop a major depressive disorder in a later interview (Buysse et al, 2008), 19.3% co-occur with anxiety, (Taylor et al, 2005) and many engage in substance abuse (Harvey 2002). Not surprisingly, insomnia is a high-costing health problem, as it creates a high number of visits to hospitals and doctors from the people who suffer from the secondary symptoms of insomnia, like fatigue and attentional problems (Taylor et al., 2017).

Considering the importance of sleep in our lives and the significant complications sleeplessness entail, efficient treatments for insomnia are indeed crucial. In the last three decades, there has been a growing interest in mindfulness as an intervention to insomnia (Khusid & Vythilingam, 2016). Mindfulness can refer to a way of living or seeing the world, a specific skill one practices when you are meditating, or as a treatment if used in a clinical context. As a way of seeing the world, mindfulness can be described as an “inherent state of consciousness” (Shapiro et al., 2006, p.374) where the individual is “paying attention, in a particular way, to the present moment” (Kabat-Zinn, 2003, p.145). Although mindfulness comes from Buddhism and forms the core of eastern philosophy, it is nevertheless a universal, inherent skill that can be trained (Kabat-Zinn, 2003). Mindfulness is trained through meditating; hence treatments wishing to increase mindfulness include daily meditation sessions. Meditation is where one observes their present state and accept the arising of thoughts, feelings and emotions. Thus, there is a focused attention which is reflective, open-minded and experiential. So, mindfulness meditation facilitates increased insight, self-regulation and

emotional-regulation (Baer, 2009, p.18). During mindfulness meditation, the practitioner is invited to sit down, practice a non-judgmental observation of the present moment, and to witness their field of consciousness without attaching any values to it (Astin, 1997). Mindfulness based treatments (MBTs) incorporate facets of mindfulness in their therapy sessions. For instance, the facets of *letting go*, *non-judgment*, *non-attachment*, *observing*, and *beginner's mind* are incorporated into the MBCT-I (Ong & Sholtes, 2010). In their model, trusting your body's cycle of sleep, *non-judging* the state of being awake, establishing a *beginner's mind* every night, *non-attachment* to the idea of having to have a good night's sleep for an efficient day, *letting go* of the sleep ideal, *patience* with the process of therapy and *accepting* the current state you are in, be it awake, fatigued or alert, are the mindfulness facets that are important for treatment. Mindfulness practices aim to expose individuals to negative emotions, and fosters acceptance of these emotions rather than reacting to them mindlessly or denying and suppressing them (Rusch et al., 2018). Among the benefits of mindfulness, studies talk about decreased rumination (Chambers et al., 2007), positive reappraisal of situations (Garland et al., 2016), and reduced emotional reactivity (Baer, 2009). These factors may be beneficial to sleeping (Rusch et al., 2018).

But why are MBTs necessary as insomnia treatments when other options are available? We can answer this question by explicating the current state of insomnia treatments. Currently, one of the abundant ways of treating insomnia is pharmacological treatment (Barros et al., 2018). Although pharmacological treatments, like hypnotics or benzodiazepines, are chosen for their immediate effect and a rather low cost, it is overlooked that hypnotics have a high possibility of causing a sedative co-dependency (Barros et al., 2018), tolerance issues, daytime drowsiness (Taylor et al., 2017) and withdrawal effects. Hypnotics are further criticized for shifting the attention away from the root cause of chronic insomnia towards the expectancy of instant symptom relief (Carney et al., 2005). Thus, instead of a pharmacological fix, a multicomponent, non-pharmacological, individual-specialized treatment is sought after (Reynolds & Cone, 2018). The most common psychological multi-componential treatment used for insomnia is Cognitive Behavioral Therapy (CBT). However, the multicomponent CBT is not cost-effective: it requires a highly-trained, therefore expensive personnel (Reynolds et al., 2018) and a long treatment period (Taylor et al., 2017). Further, a significant part of chronic insomnia patients, about 40%, do not respond to

CBTs (Morin et al., 2009) since therapies like sleep restriction can be intense, and require a commitment for a long period of time (Rusch et al., 2018).

These reasons highlight the necessity of offering MBTs as a possible treatment for insomnia. As an example to the MBTs, Mindfulness Based Therapy for Insomnia (MBCT-I) can be given. In MBCT-I, principles of mindfulness meditation meet with behavioral therapies like stimulus control, sleep hygiene and sleep restriction (Ong et al., 2018). MBCT-I uses the concepts of curiosity, non-judgment, and awareness as its basis and cultivates a mindful confrontation with sleep-related problems (Ong & Sholtes, 2010).

Although some research papers suggest that practicing mindfulness improves insomnia symptoms, a systematic review of the existing papers about the effectivity of mindfulness practices in improving sleep parameters of insomnia is scarce. This systematic review aims to add up to the literature about the efficacy of mindfulness, while answering the question whether mindfulness based treatments for insomnia is effective or not. This is done by exploring current quantitative and qualitative literature. Due to heterogeneity of the papers in their methods, sample sizes, statistical methods, and usage of MBTs (some studies including cognitive therapies, relaxation, and other studies not), the efficacy of MBTs as a treatment for insomnia is an ambitious question to provide an answer to. Thus, rather than trying to provide an exhaustive and definitive answer, the aim of this review is to evaluate the current evidence on mindfulness based treatments and their take of effectivity of MBTs in decreasing insomnia symptoms. The insomnia symptoms are seen as the Pittsburg Sleep Quality Index's parameters; mainly: Sleep quality, Sleep Efficiency (SE), waking up after sleep onset (WASO), total sleep time (TST). Yet, the papers do not always treat these symptoms separately, so, a general approach is taken by this paper too. In other words, the symptoms of insomnia are discussed as a chunk not separately due to the nature of papers discussed in this review. In the main body, first, the more quantitative, measurement-based studies which take relevant universal scores as their method will be explored. Whether there is or there is not a significant change in sleep onset latency, total sleep time, sleep efficiency and sleep quality with the MBTs is discussed through the quantitative studies in detail. Second, the qualitative data, case-reports and interviews about MBTs and their efficacy on insomnia symptoms is discussed. Third, one paper exploring indirect evidence, in which the secondary

symptoms of insomnia is aimed to be alleviated by certain mindfulness based conditions or states are discussed. Thus, this systematic review aims to explore the efficacy of mindfulness based treatments from three different approaches: a quantitative, a qualitative, and an indirect approach. The reason behind having different point of views is the possibility of decreased, or masked importance MBTs might face when compared with the CBTs or when it goes under large systematic statistical analysis (Gong et al., 2016). Thus, answering the question of the efficacy of MBTs through different point of views is believed to incorporate more ideas. At the end of this review, it is aimed to have a general layout and discussion about the topic, as well as to be foster an open-minded and approach in how we discuss mindfulness and insomnia. The hypothesis of this systematic review is that the overall, general literature will suggest that mindfulness based techniques are indeed beneficial in improving sleep parameters.

OBJECTIVE

Although studies which focus on the efficacy of mindfulness exist, especially studies comparing the mindfulness based approaches with other therapies, there is still an ongoing debate about the actual efficacy of mindfulness based treatments in decreasing insomnia symptoms. The aim of this review is to add up on to the existing literature, explore it, and discuss the efficacy of mindfulness based treatments in decreasing the insomnia symptoms in a novel manner: first in a quantitative, then in a more qualitative, and lastly through some indirect but inspiring evidence where future research can be directed towards.

This three mannered approach in exploring the effectivity of mindfulness based treatments comes from the need to answer a very general research question "How effective is mindfulness based treatments in decreasing insomnia symptoms?" and the need to specify the topic for better elaboration. Further, I wanted to present the discrepancy between the theories, or conceptualizing about mindfulness based treatments and the experimental research that comes after it. The two, just like in the case of mindfulness based approach in treating insomnia, does not always coincide. Furthermore, I also have the aim of exploring less substantial, more indirect evidence which could link mindfulness to insomnia in different ways. My aim at this section is to stir up discussions and increase the ways of talking about effectivity of mindfulness based treatments to insomnia-related symptoms.

Inclusion and Exclusion Criteria

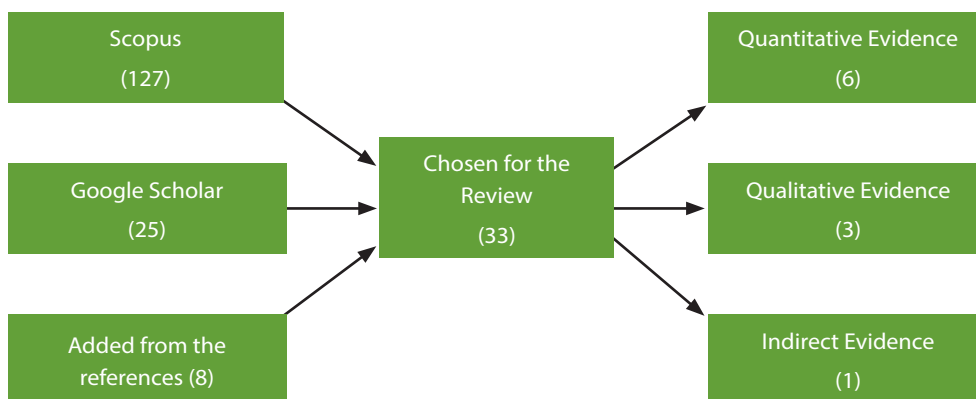
The articles were selected based on their relevance and were not excluded based on their methodological quality. A big reason for this is the rather scarce sources available at the topic of mindfulness and insomnia. Further, only a pool of authors discusses and makes experiments on this topic. Many experiments either directly compare mindfulness to cognitive behavioral therapies or pharmacological therapies, or to another control group. Thus, if the papers were to be chosen specifically by how they compare MBTs to other treatments, not enough papers would have been available. Similarly, when deciding on which mindfulness treatments to choose, no single treatment was chosen, all treatments which included mindfulness in their methods were seen eligible. Empirical papers were included if they employed mindfulness techniques, however, there was no strict requirement regarding the way in which they included mindfulness. MBSR, MBCT, MBCT-I were all seen to be acceptable treatments. Mindfulness studies aiming to treat insomnia in cancer patients, pain or fibromyalgia studies which included insomnia, were not excluded from the search since they were seen also to be informative and innovative in the way they discuss insomnia. Furthermore, comorbidity in the case of insomnia

is significantly common, and chances of finding a paper discussing only insomnia patients is scarce. Thus, comorbid papers were not seen as limitations but rather assets that could be useful in discussing symptoms of insomnia. No publication date was endorsed on the choice of the literature due to the nature of literature on mindfulness; mindfulness has been a concept that received interest in the last thirty years, and novelty does not necessarily mean quality in the literature about mindfulness. To ensure that all articles were of high quality only peer-reviewed papers were included.

The search was limited to title, abstract and keywords. Relevant sources were identified reading the abstract; all sources that were duplicates or non-English were excluded. Following this initial evaluation, the selected papers were read carefully. Empirical studies that did not refer to insomnia were not excluded; empirical studies regarding emotions and mindfulness, or cognitive flexibility and mindfulness, were included. This is again to provide a better discussion which take many point of views into consideration. The process of excluding and how the number of articles excluded at each step can be seen at Table 1, *The Literature Search* and at Graph 1, *The procedure of choosing papers*.

Table 1: The literature search

<i>The initial Review with the Keywords</i>	<i>Based on title</i>	<i>Based on Abstract reading</i>	<i>Based on article reading</i>	<i>Doubles removed, only English sources</i>
Scopus	127	72	30	33
Google Scholar	25	9	6	
Added Extra	8	6	8	
Totals	160	87	44	33



Graph 1. The procedure of choosing the papers.

SEARCH METHOD

As demonstrated in the Table 1, *The literature Search*, I chose thirty-three articles to review at the end of my search. In the screening phase, the search was performed in the databases Scopus and Google Scholar. The bibliography of the chosen papers was further manually searched for additional references. The searches were performed between the 27.04.2019 and 20.05.2019., using the search strings:

“Insomnia” AND “Symptoms”) (“Efficacy” AND “Mindfulness based treatments”) OR (“Efficacy of Mindfulness Therapy” AND “Insomnia”) OR (“Mindfulness” AND “Insomnia”) OR “Mindfulness”.

Afterwards, as it can be seen in Graph 1, I divided my evidence of 9 total papers from this chunk of chosen literature. The rest of the literature was used as means of sources of information in the rest of the systematic review.

Quantitative Evidence

In this section, some recent research is discussed in order to explore the efficacy of MBTs in alleviating insomnia symptoms. Specifically, how mindfulness-based treatments affect sleep quality, sleep efficiency, wake up after sleep onset (WASO), sleep onset latency (SOL) and total sleep time (TST) is of interest in this section. These parameters were chosen from the Pittsburg Sleep Quantity Index (PSQI) and are conceptualized to be insomnia symptoms which are to be alleviated by MBTs. As the general score of PSQI decreases, the insomnia symptoms are thought to be improved. Sleep onset latency refers to the time taken between going to bed and falling asleep. Total sleep time is the overall time spent asleep in a day. Sleep quality is a subjective feeling of how well you have slept. In this section, first, some pilot studies, then some comparative studies, and lastly, two meta-analyses will be discussed. For a summary of the first and second sections of the results section, Table 2 can be viewed.

Heidenreich, Tuin, Pflug, Michal and Michalak (2006), in their paper “*Mindfulness-Based Cognitive Therapy for Persistent Insomnia: A Pilot Study*” aimed to examine the effects of Mindfulness Based Cognitive Therapy for Insomnia (MBCT-I) for patients with comorbid, primary and persistent insomnia. Their specific hypothesis was first that MBCT-I would increase TST and decrease SOL. Second, it was that MBCT-I would reduce dysfunctional thought-control strategies. The patients with psychotic disorders or who was going through current major or manic

episodes were excluded from the study. However, due to the comorbid nature of insomnia, seventy-nine percent of the participants had a comorbid DSM-IV disorder. The fourteen participants were measured through sleep diaries for TST and SOL, and psychological questionnaires for dysfunctional thought-control strategies, before and after the treatment. The results of the study revealed significant improvements in TST and SOL between the baseline and post-treatment. The participants showed no significant changes regarding thought suppression, however they showed significant improvements in focusing less on sleep-related content and worrying. The limitations of the study were the small sample size, not having a control group, and the inability to show the temporal stability of the results. Furthermore, the difference between the efficacy of mindfulness and the efficacy of the cognitive component in MBCT-I was not clear; it was not clear whether the efficacy of MBCT-I came from the mindfulness or the cognitive component. This pilot study concluded that MBCT-I can aid with changing cognitive processes that maintain insomnia, and suggested MBCT-I to be a cost-effective treatment option for persistent and severe insomnia patients.

In a similar fashion, Yook et al. (2008) aimed to explore the efficacy of Mindfulness Based Cognitive Treatment (MBCT) for treating insomnia comorbid with anxiety disorders. After an eight-week MBCT clinical trial, the nineteen participants were measured with PSQI, Penn State Worry Questionnaire, Ruminative Response Scale, Hamilton Anxiety Rating Scale and Hamilton Depression Rating Scale. The MBCT blends mindfulness meditation with cognitive components like stimulus restriction, sleep hygiene, with meditation and sleep-related homework. PSQI measured the subjective measurement sleep quality, habitual sleep efficiency, sleep latency, use of sleep medication, sleep duration and daytime dysfunction. Sleep diaries were given as a homework to the participants to control their sleep hygiene habits. At post-treatment, the PSQI scores were significantly lower and a large effect size for the change between baseline and post-treatment for PSQI were found. However, an exception for the PSQI scores were the TST, as no significant change in total sleep time was observed. From the Hamilton Depressive and Anxiety scales, significant improvements were observed in rumination and worrying. Furthermore, a significant decrease in depressive and anxiety symptoms was also observed. Thus, the authors concluded that MBCT for insomnia can be beneficial in reducing sleep problems (PSIQ) in persistent

insomnia, and further decrease anxiety, depression, rumination and worrying. Yet, the limitations of this study must be considered: no-control trial, a possible placebo effect, and small sized group.

The studies discussed so far had no control groups, and this decreases validity of their conclusions. So, it is necessary to include studies which had a control group in assessing effectivity of MBTs in improving sleep parameters. Zhang et al.'s (2015) study did have a control group, and they aimed to explore the effectivity of Mindfulness Based Stress Reduction (MBSR) for persistent, comorbid and chronic insomnia for the elderly. The sixty participants in the study were older than seventy-five, and they suffered from comorbid insomnia with depressive or anxiety symptoms. The participants were assigned to either a waiting control group or an eight week MBSR group. Further, they were measured by PSQI at pre and post-treatment. The results revealed a significant decrease for the global PSQI score of MBSR group, but not the control group. Thus, the authors concluded that MBSR can be beneficial in improving insomnia symptoms for elderly patients with anxiety and depression.

Furthermore, all the studies discussed until now have small sample sizes. Garland, Carlson, Stephens, Antle, Samuals & Campbell (2014), in their paper "*Mindfulness-Based Stress Reduction Compared with Cognitive Behavioral Therapy for the Treatment of Insomnia Comorbid with Cancer: A Randomized, Partially Blinded, Noninferiority Trial*" had the larger aim of demonstrating the statistical non-inferiority of mindfulness treatments for reducing insomnia symptoms in cancer patients in a study with a large sample size. They hypothesized that mindfulness treatments would have an additional well-being benefit for the patients when compared with CBT-I. They compared Mindfulness-Based-Stress-Reduction (MBSR) with Cognitive Based Therapy for Insomnia (CBT-I), with sleep measurements like sleep quality, stress symptomatology, mood disturbance and dysfunctional sleep beliefs. The CBT-I program consisted of stimulus control, sleep restriction, cognitive therapy and relaxation training, while the MBSR program consisted of psycho-education, meditation techniques and gentle yoga. In this blind study, the patients who had other sleep disorders were excluded from the study and the rest were randomly assigned to one of the treatment options. The evidence from this study suggested MBSR to be statistically non-inferior to CBT-I although CBT-I showed greater improvements in insomnia severity immediately after the program and

maintained at further follow-ups. Moreover, the MBSR group did not show any additional psychological well-being benefits. MBSR showed delayed or ongoing effects between the baseline and after the program, whereas CBT-I group demonstrated greater change between the start of the program and at follow-ups. Further, CBT-I group was overall better in improving subjective sleep onset latency, sleep effectivity, sleep quality and dysfunctional sleep beliefs. Thus, although the non-inferiority of mindfulness based treatments were demonstrated at five-month follow up, CBT-I was still concluded as a rapid and durable treatment option for cancer patients with insomnia. As said earlier, this study had a large sample size (N=376), and each factor was statistically measured and calculated, which increases the validity of the study. However, the biggest limitation of the experiment was the significant attrition rate observed in the MBSR group. Also, there also was not a control-group present in the study. For the authors, this fact highlights the importance of patient motivation and preference for efficacy of mindfulness treatments to be demonstrated at a study.

Gross et al., (2011), also aimed to examine the effectivity of MBSR as a possible treatment to chronic, persistent insomnia when compared with a pharmacotherapy (PCT). The MBSR included sleep hygiene, mindfulness meditation training for eight weeks, and also ongoing homework for meditation practices. According to statistical results, no significant differences between the MBSR and PCT were found over time for sleep quality or life outcome. According to the sleep diaries, on the other hand, MBSR was found to have a larger impact on SOL than PCT. So, according to the results, MBSR combined with a brief sleep hygiene presentation was seen to be as effective as a sedative hypnotic in decreasing the symptoms of insomnia. Due to the small sample size of the study, no statistical significance was found. What was further interesting in this study was that more patients reported being satisfied at MBSR study than at the PCT.

Gong et al. (2016), compared 6 studies in their meta-analysis "*Mindfulness Meditation for Insomnia: A meta-analysis of randomized controlled trials*". In their discussion, they suggested that Mindfulness Meditation, when compared with an attention or waiting-list control group, contributes to improving total wake time, sleep onset latency, PSQI scores, sleep quality and sleep efficiency. Yet, the improving effects of mindfulness meditation on total sleep time was not found to be significant. Further, the authors discuss the triviality of mindfulness meditation

when compared with other, more established treatments like CBT. When compared with other treatments, the effectiveness of mindfulness treatments seems to not be as significant as when they would be compared to control groups. The authors cite this as “the real effect of mindfulness meditation on insomnia is underestimated or masked” when compared with cognitive behavioral therapy or pharmacotherapy (p. 5). The small sample sizes of the included studies is an obstacle in making statistical analysis that would prove otherwise for Gong et al. (2016).

At their large meta-analysis “*The effect of mindfulness meditation on sleep quality: a systematic review and meta-analysis of randomized controlled trials*”, Rusch, Rosario, Levison, Olivera, Livingston, Wu and Gill (2018) tried to only focus on RCTs to finally find which sleep parameters mindfulness would effect on. Their aim was to decrease the inconsistencies in the literature, and viewed MBTs as a second-line treatment in decreasing insomnia symptoms. A difference of this study was that the authors included a large analysis techniques in their choice of literature, increasing their validity. They included actigraphy, self-report questionnaires on sleep quality and diaries. Furthermore, they only included studies with active-control groups in their analyses. In their conclusion, they stated that mindfulness meditation techniques were able to improve sleeping conditions in a variety of clinical populations with different conditions. Yet, although their results indicated an effect of mindfulness meditation when it was compared to nonspecific active control groups, no beneficial effect of mindfulness meditation was observed when it was compared to other treatments. Specifically, at five and twelve month-follow-up, mindfulness meditation was as effective as other evidence-based insomnia treatments and improved sleep quality when it was compared with active control groups. Thus, they stated that a long-term effect of mindfulness meditation in decreasing insomnia symptoms were observable. Yet, a dose-response relationship was not observed between the time spent on meditating and decrease of insomnia symptoms. Limitations to this meta-analyses coincides with the limitation of the other studies explored in this section as some of the studies explored here was also chosen for the meta-analyses of Rusch et al. (2018). Heterogeneity of the methods of the studies, the heterogeneity of the scales used in different studies, high attrition rate for MBSR, the use of subjective measurements or diaries rather than objective methods (like actigraphy) are listed as some of the limitations of this study. Overall, taking the limitations into consideration,

the authors declared that more randomly-controlled-trials were necessary to reach an exact conclusion about the efficacy of mindfulness based therapies in treating insomnia.

As is seen in this section, the studies existing in the current literature about mindfulness’ effectivity on insomnia vary in their methods (comparisons, sample sizes, target groups, comorbidities), and which mindfulness based treatments they employ (MBCT-I, Mindfulness Meditation (MM), MBSR). Naturally, their results about the efficacy of mindfulness based treatments in treating insomnia symptoms vary greatly. Yet, as a general conclusion, it can be stated that mindfulness-based treatments, although not being as significant, durable or immediate in their effects as CBT, can be effective in decreasing the sleep-related worrying, and PSQI scores of sleep onset latency, sleep duration, sleep quality and sleep efficiency when compared to a control group (Zhang et al., 2015). Furthermore, Gross et al. (2011) suggests MBSR to be comparable in its efficacy to pharmacotherapy. However, when making these statements, the low significant effect of the results must be considered. As a general fashion, pilot studies or studies with a small sample size and control groups show significant results for the effectivity of MBTs to chronic, comorbid insomnia patients. However, larger follow-ups to these pilot studies which compare mindfulness-based treatments with other treatments, like cognitive behavioral therapy, with statistical analysis and statistically larger samples fail to show a significant effect of mindfulness practices on decreasing PSQI scores. This increases the doubts, of course, whether mindfulness based treatments are actually effective in the general picture, and whether they should be given as first-line treatments to insomnia patients when they are not as effective as other evidence-based treatments, but show their effects in longer time. However, when the uniqueness of mindfulness practice is taken into account, it is clear that there are some issues in making a definite judgment. For instance, the motivation of the patient in undergoing mindfulness treatment is crucial for mindfulness treatments to work (Garland et al., 2014). Furthermore, the subjective and complementary nature of a mindfulness based approach may not be shown in statistical analyses against more evidence-based treatments. For persistent, chronic insomnia patients, novelty in their way of looking to insomnia can be of asset, thus utilizing MBTs. So, different point of views in exploring the subject of mindfulness and insomnia might be necessary. In the next section, more qualitative accounts of MBTs decreasing the PSQI scores and other insomnia symptoms will be explored.

Qualitative Reports

As the quantitative measurements or statistical analysis might not always tell the whole story, some research papers try to follow a more qualitative, or dialogue-based measurement techniques in trying to explore the effectivity of mindfulness based treatments in decreasing insomnia symptoms. For example, Hubbling, Reilly-Spong, Kreitzer and Gross, (2014) in “*How mindfulness changed my sleep: focus groups with chronic insomnia patients*” invited chronic insomnia patients who underwent an eight week MBSR study to five-month post-trial focus groups where participants explained their sleep routines, feelings and their overall life. The meetings were recorded, transcribed and analyzed with content-analysis. At the analysis, four themes were listed. These were: the impact of mindfulness on sleep and on motivation to adopt a healthy life style, challenges and successes in adopting mindfulness-based practices, and the importance of group support. Regarding these themes, the nine patients in the post-trial groups revealed that their sleep onset latency lowered, their numbers of waking up after sleep onset (WASO) decreased, that they woke up feeling more refreshed, and the quality of their sleep rather than the duration of their sleep increased. They disclosed that they were feeling less stressed, and more accepting towards themselves and their sleeplessness. Furthermore, the participants disclosed that they felt an increased motivation to change their lifestyle into a healthy one: “Participants indicated that MBSR facilitated making behavioral changes, with comments about being more conscious and intentional about their sleep routine” (p.5). Moreover, participants told that meditation helped them achieve a holistic change, where they were more aware of the present moment, and able to rewind easier into an accepting and relaxed state. With these qualitative results in mind, the researchers consider MBSR and sleep hygiene education in a group format an adequate chronic insomnia treatment when compared to pharmacotherapy.

With similar motivation to Hubbling et al.; Morone, Lynch, Grec, Tindle and Weiner (2014; 2008), used content analysis to analyze diaries of elderly patients with low-back pain who underwent an eight-week mindfulness meditation program. Alongside to their pain relief, the participants reported decreased sleep latency, increased quality of sleep, and ‘getting back to sleep more readily after awaking at night’ (p.844). A participant reported sleeplessness to be harming the quality of her life, and that practicing mindfulness meditation has made a big difference (p. 845).

In their case-report “A Mindfulness-Based Approach to the Treatment of Insomnia” Ong & Sholtes (2010) discuss their patient ‘Maria’, who had psychophysiological insomnia comorbid with generalized anxiety disorder. Maria experienced heightened arousal and conditioned response to sleep stimuli, like her bed (p. 1180). She reported of having increased sleep-related thoughts, and problems in daytime functioning. Thus she took part in the eight week MBCT-I treatment which was delivered in a group format. The sessions of MBCT-I include silent and movement meditation practices, group discussions about meditation and its effect on insomnia, and educational talks on sleep hygiene, sleep restriction and stimulus control. In one of the sessions, Maria had a breakdown about not being able to control her thoughts about sleeping. However, after adopting the letting go principle, her pre-sleep arousal score decreased. Furthermore, her wake up after sleep onset decreased, sleep quality increased, and her pre-sleep arousal decreased overall. Using this as a case-report, Ong & Sholtes concluded that allowing sleep to unfold, rather than holding onto rigid thought structures about sleeping might be more beneficial for patients experiencing high emotional valence regarding their sleeplessness.

As can be seen in this section, the effectivity of mindfulness based insomnia treatment techniques may also be explored through more qualitative, conversational, experiential or interviewing-based approaches. When the unique and rather subjective nature of mindfulness is considered, qualitative evidence may be as valuable as quantitative data, especially for clinical implications. The next section further explores certain symptoms, or states which occur with insomnia, and how mindfulness based treatments can be of help in alleviating these symptoms indirectly.

Other evidence which explore the efficacy of mindfulness-based therapies in alleviating insomnia symptoms indirectly

Apart from the papers who explore the efficacy of mindfulness in decreasing insomnia symptoms directly, some papers try to explore how mindfulness based treatments or mindfulness itself would decrease the insomnia symptoms indirectly. In this section, Ong & Sholtes’ MBCT-I program (2010), which aim to decrease insomnia symptoms of SOL, TST, sleep quality and sleep efficiency through secondary arousal is discussed as an example of indirect evidence.

Table 2: Review of the discussed papers for qualitative and quantitative evidence sections

<i>Quantitative evidence</i>					
<i>Name of the paper</i>	<i>Type of paper</i>	<i>Measured parameters</i>	<i>Results</i>	<i>Limitations</i>	<i>Conclusion</i>
Mindfulness-Based Cognitive Therapy for Persistent Insomnia: A Pilot Study (Heidenreich et al, 2006)	Pilot Study	TST, Sleep Latency, Thought Control Questionnaire: Suppression, Replacement, Reappraisal, Worry, Punishment, Social Control FEPS-II: Focusing, Worry	Significant increase in total sleep time (TST), and decrease in sleep onset latency (SOL) Significant improvement for reappraisal, worry, self-punishment, social control Significantly less focusing on sleep-related content and significantly-less worry	No control-group; separate effectivity of mindfulness; small sample size	MBCT-I is a cost-efficient and effective treatment for severe insomnia.
Usefulness of Mindfulness-Based Cognitive Therapy for Treating Insomnia in Patients With Anxiety Disorders A Pilot Study (Yook et al, 2008)	RCT	Pittsburgh Sleep Quality Index (PSQI), Penn State Worry Questionnaire, Ruminative Response Scale, Hamilton Anxiety Rating Scale, Hamilton Depression Rating Scale, Sleep Diaries,	Significantly lower PSQI scores with a large effect size; subjective sleep quality, habitual sleep efficiency, sleep latency, use of sleeping medication, daytime dysfunction were all found to be significantly improved after treatment; significantly lower anxiety symptoms, worry, rumination	No control-group, a possible placebo effect, natural course of anxiety problems, small sample size	MBCT-I is useful for relieving anxiety, worry, depressive symptoms and ruminations in insomnia with anxiety disorder.
Mindfulness-Based Stress Reduction Compared With Cognitive Behavioral Therapy for the Treatment of Insomnia Comorbid with Cancer: A Randomized, Partially Blinded, Noninferiority Trial (Garland et al, 2014)		Primary outcome: Insomnia Severity Index (ISI); Secondary Outcome: Sleep diary for Sleep efficiency (SE), Sol, WASO, TST PSQI for subjective measurements and GT1M actigraphy for objective measurements of SE, SOL, TST, WASO; Calgary Symptoms of Stress Inventory for stressful states and Profile of Mood States-Short Form	non-inferiority of MBSR to CBT in five months post-trial; significant interactions between SOL and SE in sleep diaries, CBT-I better for SOL than MBSR, MBSR and CBTI equally effective for TST, both groups same for WASO; according to actigraphy: CBT-I group significant for SOL, MBSR group significant improvement in WASO, CBT-I better for sleep quality, dysfunctional sleep beliefs	Differential attrition between groups: MBSR group had high drop-out rate	Noninferiority was only demonstrated at the five month-follow-up, CBT-I remains to be durable and rapid for cancer patients.
Mindfulness-Based Stress Reduction for Chronic Insomnia in Adults Older Than 75 Years: A Randomized, Controlled, Single-Blind Clinical Trial (Zhang et al, 2015)	RCT	PSQI global score; Self-rating Anxiety Scale, Geriatric Depression Scale	significant decrease in PSQI score at MBSR group the most significant being the day time dysfunction; no significant change in SAS, significant group x time interaction in GDS		MBSR is beneficial to chronic insomnia aged over 75.
Mindfulness-based stress reduction versus pharmacotherapy for chronic primary insomnia: A RCT (Gross et al, 2011)	RCT	ISI, PSQI, sleep diaries, wrist actigraphy collected pre-treatment, post-treatment (eight weeks) and five months later	Large, significant improvements in SOL, ISI, PSQI, diary-measured TST, SE from baseline to five months' post-treatment for MBSR comparable to PCT	Small sample size	MBSR as a non-PCT should be offered for insomnia.
Mindfulness Meditation for Insomnia: A meta-analysis of randomized controlled trials (Gong et al, 2016)		Meta-analysis of MM	MM significantly improved total wake time, sleep quality but had no significant effects on sleep onset latency, TST, WASO, SE, ISI, PSQI. Subgroup analyses showed significant effects in total wake time, SOL, sleep quality, SE, PSQI global score.		MM as an auxiliary treatment for sleep complaints can mildly improve some sleep parameters in insomnia patients.

Table 2 continuation: Review of the discussed papers for qualitative and quantitative evidence sections

Quantitative evidence					
Name of the paper	Type of paper	Measured parameters	Results	Limitations	Conclusion
The effect of mindfulness meditation on sleep quality: a systematic review and meta-analysis of randomized controlled trials (Rusch et al, 2019)	Meta-analysis		No öşe-response relationship between in-class meditation hours and sleep quality was found; Five months' post-treatment MM significantly improved sleep quality compared with non-active control groups but not with evidence-based sleep treatments.	Substantial heterogeneity of the papers	Mindfulness meditation can improve sleep quality in a variety of clinical populations with sleep disturbance.
Qualitative evidence					
How mindfulness changed my sleep: focus groups with chronic insomnia patients (Hubbling et al, 2014)		focus groups, audio recordings	SOL, WASO improved, sleep quality improved, TST increased, motivation to change life increased, people were likelier to change their sleep routines	Small sample size, not quantitative data	MBSR is an adequate nonpharmacological insomnia treatment compared to PCT
The effects of mindfulness meditation on older adults with chronic pain: Qualitative narrative analysis of diary entries (Morone et al, 2008)		Qualitative narrative analysis of diary entries	SOL decreased, sleep quality increased, easier to fall asleep after waking up at night, decreased sleeplessness	Small sample size, not quantitative data	MM is beneficial
A Mindfulness-Based Approach to the Treatment of Insomnia (Ong et al, 2010)	Case-report		Pre-sleep hyperarousal decreased, SOL decreased, sleep quality increased,	Case-report	Letting go principle is beneficial in improving sleeplessness at psychophysiological insomnia.
SOL, sleep onset latency; TST, total sleep time; WASO, wake up after sleep onset; SE, sleep efficiency; MBSR, mindfulness-based-stress reduction; MBTs, mindfulness-based-treatments; PCT, pharmacotherapy; non-PCT, non-pharmacotherapy; MM, mindfulness meditation; MBCT-I, mindfulness based cognitive behavioral therapy for insomnia; PSQI, Pittsburgh sleep quality index.					

MBIs effect on Day-time Symptoms and Cognitive-Emotional Arousal

In order to explore the efficacy of mindfulness based treatments in alleviating daytime insomnia symptoms and cognitive-emotional arousal, Ong, Xia, Smith-Main, and Manber (2018), divided their participants into three different trials: MBSR, MBCT-I and delayed-treatment control. MBSR consisted of eight weeks, where meditation practices, group discussions and gentle yoga practices. MBCT-I was applied as a group intervention training consisting of behavioral components. Instead of psychoeducation and sleep hygiene, MBCT-I included sleep restriction therapy, stimulus control. The delayed-treatment control group, on the other hand, received the task of keeping daily sleep diaries for eight weeks (TST), and then going through an eight week of standard behavioral treatments for insomnia (BT), like sleep restriction, stimulus control and sleep hygiene.

The daytime functioning and cognitive-emotional arousal of the patients were recorded with self-ratings, checklists after each session and weekly logs. To measure sleep-related cognitive and emotional arousal, self-reported sleeping effort and sleep-related cognitions were recorded. Further, a hyperarousal scale, daytime fatigue and sleepiness, and global emotional functioning were measured with several scales and later analyzed. The data suggested the results of: MBCT-I having a non-inferiority to BT and a large effect size on sleep effort, general hyperarousal, and maladaptive sleep-related cognitions. None of the interventions created a difference in daytime sleepiness or fatigue. The authors conclude that targeting sleep-related arousal can be beneficial in decreasing insomnia related sleep problems. When compared with MBSR, the data suggests that MBCT-I, a program combining cognitive behavioral and meditation techniques to be superior in decreasing the sleep effort, hyperarousal or sleep-related cognitions.

CONCLUSION AND DISCUSSION

In this systematic review, the efficacy of mindfulness-based-treatments in relieving insomnia was discussed. While doing that, the evidence gathered was divided into three sections: quantitative evidence, qualitative evidence and indirect evidence. The first and the second sections explored the efficacy of mindfulness based treatments in decreasing insomnia symptoms accordingly to PSQI scores. The third section can be inspiration for future evidence, and tries to cover the indirect links between mindfulness and insomnia symptoms. Alongside the primary aim of exploring the efficacy of mindfulness treatments, a secondary aim of this systematic review was to show the importance of qualitative reviews and so a section was allocated to qualitative data. The level of efficacy of mindfulness based treatments as an insomnia treatment has been a heated debate, and although it's beneficial effect on sleep onset latency, sleep quality, sleep duration, waking up after sleeping has been shown in different papers, a definite number or statistical power is difficult to reach. This is due to numerous reasons: First, there exists varying meditation techniques: MBSR, MBCT-I, MM being the most common. Each of these techniques include different components. MBSR includes sleep hygiene, MBCT-I behavioral and cognitive interventions, and MM contains only meditation. Each paper utilizes a different way of incorporating mindfulness to their interventions, and there is no universal way to evaluate the intervention credibility of these different treatment types. Consequently, an objective comparison between different MBTs are not yet possible. Thus, this review chose to include all the possible types of mindfulness practices, and to explain them in detail with their method section. Although the current studies show the non-inferiority of MBCT to CBT on the long-term in variety of clinical populations, CBT still continues to be more efficient and effective than MBCT in alleviating most insomnia symptoms. An exception might be the subjective feeling of having woken up refreshed, which was explored by Garland et al (2016), or SOL and TST being more affected by MBCT than PCT (Gross et al.). The papers discussed at this systematic review show that MBTs may be as effective as a pharmacotherapy, since PCTs' create low satisfaction and abuse problems.

Out of the MBTs discussed in this review, the most efficient type of MBCT is MBCT-I, which incorporate mindfulness elements to cognitive and behavioral components in treating insomnia. When the heterogeneous and complex characterization of insomnia is considered,

it makes sense that a treatment offering different components is an efficient way to tackle insomnia. Yet, the high efficacy of MBCT-I creates the inability of differentiating the separate efficacy of the mindfulness component from the other components in the therapy. No specific sleep symptom was found to be more effected by MBTs than other sleep parameters due to large inconsistencies between the results of the papers reviewed. Thus, this review chose to discuss all the PSQI scores as a single entity. Table 2 can be of help in understanding what the papers in this review entailed, and what their conclusions were. A result that strikes the eye is that MBTs are more effective in decreasing SOL than PCT. Yet, this result was not replicated in other papers. Overall, the general conclusion that MBTs alleviate the general PSQI scores is a more accurate, although a shallow conclusion that can be reached from the present evidence.

One of the more specific limitation of this review is the variance of the conceptualizations of MBTs in general. Not only is different MBTs used in different papers, but also papers have varying target audiences and different conceptualizations of what the aim of MBTs should be. Thus, their discussion of the effectivity of MBTs can differ greatly. For example, for Rusch et al. (2018), MBTs are seen as second-line treatments, when first-line treatments fail to work. Thus, they find it to be efficient in helping against persistence insomnia symptomatology when everything else fails. Yet, other papers may conceptualize the aim of MBTs as a primary treatment, as it happens when MBCT is compared with well-established PCT or CBT. In fibromyalgia and cancer patients, MBTs may be seen as more primary treatments that decrease sleep-related problems alongside pain. Thus, the results of each paper about how efficient the MBTs may become situation-specific. Yet, I believe that this limitation does not overrule this papers conclusion that MBTs, even though they fail to have a significance when compared against CBTs as a primary first-line treatment, can still prove to be beneficial for a specific target group as a first-line treatment for insomnia. To prevent misunderstandings, authors must be explicit in how they conceptualize MBTs in their papers. Another limitation of this systematic review was having to make the distinction between quantitative and qualitative data. This distinction was helpful in exploring different type of papers, however, certain RCTs also just employed qualitative data as their measurement techniques. For example, although sleep diaries and self-report based questionnaires are qualitative in nature, they are regarded and analyzed

as quantitative data by the papers. This understanding was followed in this thesis: subjective and objective measurements recording sleep symptomatology in RCTs or pilot studies was seen as quantitative data. Papers exploring interviews, statements, or case-reports were seen as qualitative data. This created an out-numbered exploration of quantitative data. This is simply because there exists more quantitative than qualitative data in databases. Thus, qualitative data is also under-reported in this systematic review.

One last discussion point of this systematic review is to focus on the unclear nature of mechanism of mindfulness alleviating insomnia symptoms. Indirect evidence, as was discussed in the third section of the main body in this review, point to a cognitive shift, or a re-perceiving (Shapiro et al., 2006) that enables the practitioner of meditation to reappraise her situation of insomnia. Other authors, like Ong et al. (2012), point to increased metacognitive awareness caused by MM as a reason for the decreased pre-sleep hyperarousal. Garland et al., (2014) in a similar note, explore how positive reappraisal of negative thoughts is facilitated through non-judging, persistent observation of the arising emotional states. Baer (2009) explores that when the individual observes their emotions their avoidance and fear of their emotions decrease. She further explains her point through letting go of the evaluative stance towards certain emotions as “good” or “bad” contributing to reduce emotional reactivity to sleeplessness. Not identifying with arising emotions may decrease emotional vulnerability (Baer, 2010). The facets of mindfulness also have a role in here: acceptance without judgment decreases emotional distress (Hansen et al, 2009). Greater levels of observing, describing, acting with awareness, accepting without judgment increase the feeling of coping self-efficacy (Luberto, Cotton, McLeish, Mingione, O’Bryan, 2013). Overall, with increased mindfulness, the individual is better equipped to cope with their mental states (Coffey et al., 2013). This improvement in coping with mental states affects insomnia: The person is able to let go, and care less, helping them sleep better. All these possible mechanisms of mindfulness meditation have too many conceptual ideas to translate well into one paper. In the future, however, all these possible, indirect ways of linking how mindfulness could help in alleviating insomnia symptoms can be researched through separate papers. As it has been suggested by Ong & Manber (2011), decreasing the secondary or complementary symptoms in the

case of insomnia can indeed decrease the insomnia, or sleeplessness itself. Unlike other disorders, treating persistent insomnia might require to focus on more complementary, but in no way trivial symptoms: rigid thought structures, catastrophizing over estimation, rumination, worrying and non-acceptance. Thus, if these secondary symptoms are focused at through different RCTs, primary insomnia symptoms may be alleviated easier.

Although the limitations of this systematic review and the difficulty of discussing and conceptualizing the topic of mindfulness as a whole, this review also had several strengths. First of all, this review had an innovative approach in discussing the evidence, as it included both the qualitative, quantitative and indirect evidence. Thus, the scope of the review was rather large, enabling the topic to be discussed from different point of views. I believe this to be an asset for the topic of mindfulness, as its value might not always be translated exactly into statistical significance. Furthermore, the evidence discussed in the paper was explored neutral and detailed as possible, so that the reader can understand the nuances between different papers. Furthermore, the topic was discussed in such a way which was not discussed in other papers, which marked its difference to the existing literature. This paper is able to offer something slightly novel also to an experienced reader.

For future research, more universal and better ways of dealing with qualitative and quantitative data is necessary to be established. If there is a common insomnia-related mindfulness questionnaire or schema, more valid qualitative and quantitative research can be made at the topic. For example, measuring all the PSQI scores might not be working, and that might be a reason why no exact conclusions are reached by all the papers. Thus, more score specific research can be designed. For example, RCTs might as well simply focus on SOL, TST or WASO or to one of these indicators rather than focusing on them as a whole. Another future point is the existence of grey areas that are necessary to be explored. These topics are mainly about the mechanism of mindfulness in decreasing the insomnia symptoms. As was discussed in detail in the prior paragraph, how mindfulness based treatments relieve insomnia symptoms, and the neurological or cognitive mechanisms behind the mechanism of mindfulness based treatments are yet only conceptualized. The follow-ups, RCTs and experimental research is thus necessary to detail and lighten the topic.

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