The Application of Mindfulness Based Therapy (MBT) in Substance Use Disorder (SUD): A Scoping Review

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Abstract

Background

With a prevalence of 7% of the world population as well as a variety of mental health comorbidities, Substance Use Disorder (SUD) is a challenge for psychological and physiological well-being and a predictor for economical and social problems, giving an effective treatment great importance. However, literature shows a mixed evidence of common therapeutical approaches to treat SUD effectively and effectiveness is always related to certain conditions, like kind of substance. Also increasing relapse rates in the long-term are still a problem. Mindfulness-based treatments (MBT) are frequently used as an alternative method. The aim of this article is to review current evidence of MBT, compared to other approaches.

Method

By using the online databases Elsevier, Scopus, Google Scholar and PubMed, an exhaustive literature search was conducted. Ten studies have been reviewed with regard to effectiveness of MBT in in the treatment of SUD.

Results

MBT turned out as an effective approach for treating SUD and in addition more effective than TAU and equally effective as CBT in the short-term, but more effective than CBT in the long-term. Compared to TAU and CBT, people treated with MBT experienced lower craving, stress, anxiety and depression.

Conclusion

MBT is an effective and flexible approach for the treatment of SUD. Reviewed studies showed long-term treatment benefits over CBT and TAU. By including individual drug intake associated factors like craving and stress, as well as clinical variables like depressed mood and anxiety, MBTs are a promising approach to tailor interventions to the individuals needs.

Introduction

This scoping review concerns application and effectivity of mindfulness-based treatments (MBT) in substance-use disorder (SUD). With an overall prevalence of approximately 7 %, SUD is among the most common mental disorders. (Arterberry et al., 2020). The prevalence differs between each kind of substance with tobacco (approximately 1 billion cases) as the most frequent, followed by alcohol (100 million), opioids (26 million), cannabis (22 million) and cocaine (6 million) (West, 2017). In addition, SUD and kind of substance is also country specific. In eastern europe, 14% of the population are meeting criteria for alcohol use disorder, while only 1% are affected in north africa and the middle east (Degenhardt et al., 2018).

SUD refers to the excessive use of substances such as alcohol, caffeine, cannabis, hallucinogens (e.g. lysergic acid diethylamide), inhalants (e.g. gasolines), opioids (e.g. heroine), sedatives, hypnotics or anxiolytics (e.g. benzodiazepines), stimulants (e.g. cocaine) and tobacco (5th ed., DSM-5, American Psychiatric Association, 2013). All substances except caffeine are comorbid with at least one different disorder which applies in particular to opioids, alcohol, hallucinogens, sedatives and stimulants (APA, 2013). Comorbid SUD have high rates with anxiety disorders, but also depression and bipolar disorder, attention-deficit hyperactivity disorder, borderline personality disorder and antisocial personality disorder (NIDI, 2018). The comorbid occurrence of both can be interdependent. On the one hand, mental illness and associated changes in brain activity may increase the vulnerability for use of substances (e.g. by enhancing rewarding effects). On the other hand, substance use can lead to changes of brain areas that are disrupted in other mental disorders (NIDI, 2018).

The essential feature of SUD is the continous consumption of a substance despite the experience of problematic substance-related cognitive, behavioural and physiological symptoms (APA, 2013). In accordance with DSM-5 (2013), symptoms are *impaired control* over regulation of substance use in frequency and period of time; *large time expenditure* to obtain and use the substance, or recover from its effects; *craving* for the substance which may occur at any time, but more likely in an environment where the substance was obtained or used before; *social impairments* like reduction of social activities, increase of interpersonal conflicts, or failure to fulfill obligations at work, school or at home; *risky use* of the substance in physically hazardous situations; *psychological problems* such as depression and anxiety; *physiological problems* such as liver and lung damage; *tolerance*, signaled by an increase of

dosage to achieve the desired effect or reduced effect when the initial dose is used and *withdrawal symptoms* like sweating, trembling, nausea, aching limbs, feeling of weakness and loss of appetite, (APA, 2013). Based on the number of symptom criteria fulfilled the course can be mild (two to three criteria), moderate (four to five), and severe (six or more) (Hasin et al., 2013).

Mechanisms of substance abuse

Drug addiction is viewed as the "endpoint of a series of transitions from initial voluntary, or recreational, drug taking through progressive loss of control over drug use" (Everitt, 2014). Transitions are subject to pavlovian conditioning and reinforcing effects, assumed to depend on increased dopamine transmission. Thus, drug-associated conditioned stimuli can remind individuals of satisfying effects, but also withdrawal, which results in craving and release and maintenance of drug seeking and taking (Everitt, 2014). Predictors are variable and broadly diversified. First, compulsive drug taking can be predicted by a general vulnerability for substance abuse and low levels of self-control (Belin et al., 2008). Second, repeated drug intake is due to avoid consequences of withdrawal through negative reinforcement (Everitt, 2014). Third, mechanisms of development and maintenance of substance use are frequently seen in psychological distress and stressful life events, whereby in particular the frequency and severity of events are strong predictors (Dawson et al., 2005). A key factor is the activation of the brain stress system in transition from drug use to abuse as it takes part in producing negative emotions which abusers have to cope with (Koob, 2008). For people with addiction, activation of the stress system is connected with drug craving (Carrol & Lustyk, 2018). Finally, cultural or familiar influences and values are assumed to affect drug abuse. If an individual's values contradict drug abuse, the person will be less likely to commit in drug seeking and taking (Thomas, 2013).

Treatment of Substance Use Disorder

Treating SUD is challenging due to high relapse rates and comorbidities. Abstinence is often not maintained, even after running multiple treatment cycles (Hser et al., 2007). Approaches mainly include a combination of psychoeducation, behavioral methods pharmacotherapy and relapse prevention (NIDA, 2018). Due to NIDA (2018), effective treatment requires fullfillment of basic principles, such as: treatment has to be tailored to the patient as treatment differs depending on the type of drug and characteristics of each

individual; treatment has to be accessible for people; treatment has to adress multiple needs of the patients (e.g. age, culture and social circumstances) and not just substance use; time for remaining in treatment has to be adequate and depends on type and degree of peoples needs and treatment should adress comorbid mental disorders.

Treatment-As-Usual

Treatment as usual (TAU) refers to general accepted standards typically applied to patients in routine mental healthcare (Kolovos et al., 2017). Most often TAU includes individual treatment, group therapy and psychoeducation. Typically, content of sessions is to assess and monitor substance use, discussing symptoms, functioning in everyday life and reflective listening. The focus here is increasingly on abstinence (Santa Ana et al., 2008). Many authors, e.g., Zemestani and Ottaviani (2016), Davis et al. (2018) and Bowen et al. (2014) use a 12-step format as TAU, e.g. by mixing psychoeducation about effects of substance use with practice of rational thinking skills. Some concepts also apply a pathological point of view on substance use. For example, relapse prevention skills partly base on disease models of addiction, e.g. the Cenaps model by Gorski (2007).

Cognitive Behavioural Therapy

Cognitive behavioral therapy (CBT) is a frequent used approach in treating SUD. It is described as a short-term, structured psychotherapy with focus on the present situation, problem solving and modification of disfunctional thoughts and behaviors (Lopes et al., 2021). The general assumption of CBT is that disfunctional cognitive processes contribute to the development and maintenance of uncomfortable emotions, physiological reactions and problematic behavioral patterns such as substance abuse. By detecting and altering disfunctional cognitions into more adaptive, beneficial cognitions the problem behavior is intended to be changed or reduced (Lopes et al., 2021). For example, individuals are helped to identify in which way thoughts, feelings and events precede and follow on substance use, and to develop and implement drug-specific coping methods (e.g. avoiding drug-associated stimuli) but also general (e.g. dealing with negative affect) (Epstein et al., 2003).

Challenges for TAU and CBT

Both, TAU and CBT are able to deliver significant reduction of substance use during treatment (Morgenstern et al., 2001). However, scientific evidence turns out to be inconsistent

when it comes to maintaining treatment gains in follow-up periods. According to Carroll et al., (2009), CBT proves to produce significant advantages in long-term effects compared to TAU. In contrast, De Crescenzo et al., (2018) reported efficacy only until the end of the treatment, but not in follow-ups after treatment completion. Generally, long-term effects for both types of treatment are considered as limited (Campbell et al., 2018). Also treatment effects on comorbid mental disorders seem to be disorder specific. According to Garland et al. (2016), CBT and TAU are effective in reducing depressive symptoms of people with SUD, while people with anxiety and post traumatic stress disorder (PTSD) do not benefit. In addition, the same study could figure out, that CBT and TAU are limited in reducing drug craving. Also, presently applied treatment approaches are often not in line with basic principles of an effective treatment. The duration of intervention differs and only considers individual factors like social environment to a limited extent (Campbell et al., 2018).

Complications in the treatment of SUD require development of alternative approaches. With the purpose of finding evidence for an appropriate alternative, the further course of this paper will review conceptualization and evidence of mindulness-based therapies (MBT).

Mindfulness Based Therapy in the Treatment of Substance Use Disorder

The idea of mindfulness is part of the positive psychological approach, which is, according to Gable & Haidt (2005) the study of conditions and processes that contribute to flourishing or optimal functioning of people, groups, and institutions. The role that mindfulness plays in positive psychology is expressed in the basic idea that "mindfulness is about attaining awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment." (Kabat-Zinn, 2003). Individuals educated in mindfulness raise awareness of internal and external experiences, become able to perceive these experiences consciously and finally, accept them. This helps them to take part in another present moment experience (Yadav, 2017). By raising awareness and non-judgmental attention, MBTs are conceptualized to help people modulate stress response, learn how to respond to uncomfortable emotions or situations and increase emotion regulation and self-control (Bautista et al., Amaro, 2019).

Taking this principle into account, mindfulness might become suitable for treating SUD. While intense drug craving and relapse is considered a central feature of SUD, Appel (2009) argues that addiction is the repeated desire to avoid the present moment which

contributes to the urge of using drugs. Therefore, practicing how to accept the present moment instead of avoiding it would decrease the urge. In SUD treatment, MBTs address craving. Witkiewitz et al. (2013) re-define craving as the subjective experience of a desire to use substances and consider this urge as a major predictor of relapse. Thus, MBTs aim for helping people to understand the nature of their desire and create strategies to diminish craving and related characteristics like impulsivity, vulnerable stress reactivity or tendencies to experience negative emotions.

A variety of treatment programmes are based on applying principles of mindfulness. With the main goal of reducing relapse in the long-term, mindfulness based relapse prevention (MBRP) is widely used. Usually, MBRPs are executed as multiweek behavioral interventions. Duration and frequency of each session depends on treatment setting and population. For example, an intervention carried out by Bowen et al. (2014) covered 8 weekly 2-hour sessions, each session with its own topic. Thus, the first weeks were about raising awareness of physical, emotional and cognitive aspects, while additional sessions included practicing mindfulness exercises, which could be executed in the presence of relapse triggers. The idea was to use mindfulness as a skill for constant improvement. Doing so, people should learn to self-regulate emotions and behaviours when being confronted with stressors. Apart of SUD interventions, MBTs aim to address additional factors relevant for SUDs, such as stress and anxiety, but also disorders connected to addiction (Yadav, 2017). In addition, mindfulness-based methods can be combined with established treatments, e.g. the mindfulness-based cognitive therapy (MBCT) (Hoppes, 2006).

As outlined before, inner processes and individual factors are crucial in the build up of craving and release and maintenance of drug seeking and taking (Everitt, 2014). Suitable, the NIDA (2018) proposes to tailor treatments to specific characteristics (e.g. social circumstances or personal needs) of each individual as basic principles for an effective therapy. However, TAU and CBT are limited, in fullfilling these principles, as well as in reducing craving and maintaining treatment benefits (Campbell et al., 2018; De Crescenzo et al., 2018) while MBTs seem to specifically focus them.

So far, research suggests benefits of MBTs compared to TAU and CBT in terms of long-term abstinence and craving (Bowen et al., 2013; Chiesa & Serretti, 2014). However, evidence for superiority of MBTs compared to TAU and CBT is contradicting. Efficacy trials by Bowen et al. (2013) found out that treatment benefits of MBRP diminished at 4 months

post-intervention to levels similar to those in TAU what was attributed to limitations of study design in which participants from the MBRP group returned to TAU groups after their 8-week MBRP course. Moreover, MBTs are evolving and are not as extensively researched as CBT and TAU. Thus, the current systematic review explores effectiveness presented by more recent publications. Over the years, the application of mindfulness based methods in SUD raised in popularity in research. Multiple systematic reviews were published recently. However, authors indicate limitations in terms of heterogeneity between studies regarding main objectives, target population and type of intervention as well as a reduced sample size of included studies. They claim that a broader search and a larger sample size would produce a more complete account of the current state of the art (Korecki et al. 2020; Ramadas et al., 2021). This is where the present study is intended to start. By including additional reviews about effectiveness and mechanisms of MBT in SUD with variable target populations, treatment methods and substances, the aim is to contribute in improving scientific evidence for an approach that increases in development and popularity, but requires a more complete state of the art.

RQ_1: “To what extent is MBT effective when treating individuals diagnosed with SUD?”
RQ_2: “To what extent do MBT, CBT and TAU differ in effectiveness when treating individuals diagnosed with SUD?”
RQ_3: “What are the mechanisms addressed by MBT that relate to the treatment of SUD?”

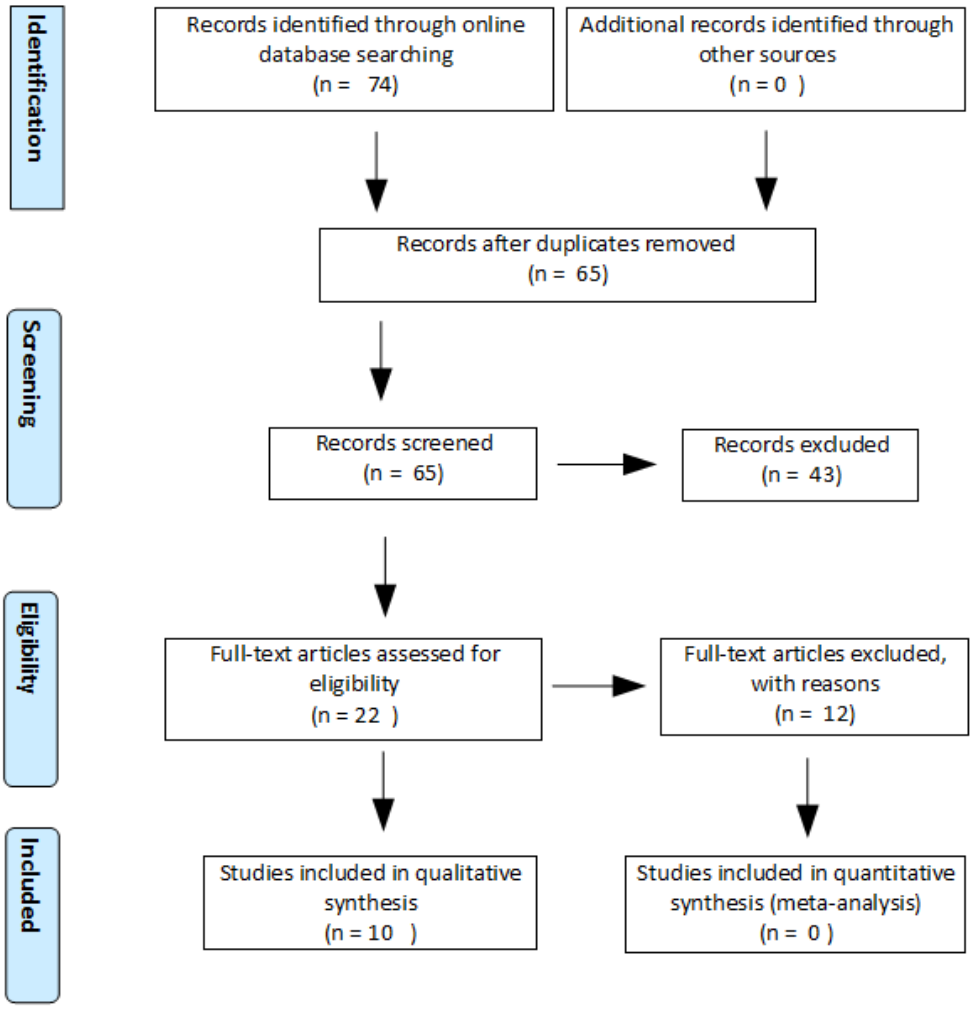
Methods

A literature search of Elsevier, Scopus, Google Scholar and PubMed has been conducted. Search terms were related to MBT, CBT, TAU and SUD and combined by using the operators “AND” and “OR” to produce search strings like (“mindfulness based therapy” AND (“cognitive behavioral therapy” OR “treatment as usual” OR “SUD” OR “substance abuse” OR “nicotine use” OR “alcohol abuse” OR “stimulants” OR “opiates” OR “...”)). A total number of 74 articles were obtained and screened for following inclusion criteria: a) studies had to contain data about effectiveness of MBT in course of SUD or compare effectiveness to CBT and/or TAU b) adressing mechanisms specific for SUD (e.g. craving and/or stress and/or specific substances) c) studies reported in English d) studies published from 2014 onwards and e) studies not included in already existing literature reviews. In total,

64 articles had to be removed, as they were either duplicates, did not meet the inclusion criteria or were not evaluated as eligible. Finally, 10 studies were included in the present review.

Figure 1

PRISMA Flow Diagram (Moher et al., 2009)



Results

A total number of 10 studies met the inclusion criteria and are presented in Table 1. All studies included one of the mindfulness based treatments MBRP or mindfulness-based stress reduction (MBSR). The studies compared these treatments to TAU, CBT or psychoeducation, or they examined the general effect of the respective treatment method on the course of drug addiction.

Objectives of the studies

The general objective of these studies was researching to what extent mindfulness based interventions, consisting of meditation, awareness, relapse prevention and homework exercises, are effective for treating SUD, also in comparison with TAU and cognitive based strategies. In this context, the studies included pre- and post-intervention measures about the participants' substance-use, craving, perceiving and dealing with stress levels, experiencing anxiety, feeling depressed and regulating impulsive behaviour.

Samples and Diagnoses

The studies included a total number of 740 participants with an age range from 18 to 70 years. Out of all participants, 101 individuals were diagnosed with alcohol use disorder, 101 with opioid abuse disorder, 128 people used stimulants, 23 used tobacco and 11 people displayed symptoms of cannabis use disorder. In addition, 333 participants were polydrug users, meaning they were using more than one drug, for example alcohol and cocaine. Three studies did not mention any specific kind of substance. Instead, randomization to treatments based on general substance use and addiction severity was measured by using the ubstance Frequency Scale (SFS) and the Addiction Severity Index (ASI). In addition, five studies only included participants with one class of drugs which were stimulants (N= 63), opioids (N= 87), alcohol (case report) and tobacco (N= 23). Furthermore, two studies included participants with comorbid disorders, which were Major Depressive Disorder (MDD; n= 101) and Generalized Anxiety Disorder (GAD; n=42).

Overall, multiple studies differed in terms of their cultural context. While six interventions were carried out in the USA, the studies by Zemestani et al. (2016), Abed et al. (2019), Fahmy et al. (2019) as well as Yadav (2017) were carried out in Iran, Egypt and India. Zemestani et al. (2016), who applied MBRP to an Iranian population,remarked that most of the development of MBRP took place in the USA and indicated the divergence between

Iranian and American concepts of self and identity. Due to them, in the USA these concepts can be seen as building blocks to personal development, self-reliance, and self-motivation while in Iran, they are an obstacle to interrelatedness and interdependence and thus restricting for mindful practices. (Zemestani et al., 2016). Nevertheless, they applied the intervention in the same form as the studies carried out in the USA, arguing that mindfulness has similar effects for both cultures.

Treatments

The occurence of treatments in the studies has been as followed: all studies included MBT (n = 10) with the programmes MBRP (n = 8) and MBSR (n = 2). Nine studies were compared to either one, or multiple of the control conditions TAU, CBT, health education (HE), standard aftercare programmes (SA) or no-intervention groups. Some studies combined different approaches with each other, or re-labeled treatment methods. The study by Davis et al. (2018) included a combination of CBT and TAU. They explicitly termed this treatment as TAU. Moreover, Bowen et al. (2014) and Carroll et al. (2018) applied CBT as control group but used the expression cognitive-behavioral relapse prevention (RP). Finally, one study used a within-subjects design by only applying mindfulness based interventions without a control condition.

Mindfulness-Based Relapse Prevention

With a total number of eight studies, MBRP was the most prevalent mindfulness based intervention. In their studies, Grow et al. (2015), Bowen et al. (2014), Zemestani and Ottaviani (2016), Carrol and Lustyk (2018), Abed and Ansari (2019) and Glasner et al. (2017) applied the MBRP manual by Bowen (2010), an intervention program specifically designed for people with substance use disorder. The mindfulness training always included two superordinate coping skills, in which participants learned (1), how to direct their attention to the present moment when experiencing craving and negative emotions, and (2) to develop an accepting attitude. The intervention consisted of eight weekly closed-group sessions, each with a duration of two hours and a number of six to thirteen participants per group. The first sessions explicitly adressed the concept of craving and introduced strategies about working with craving mindfully by doing specific meditation exercises. The next sessions thematised stress and negative emotions and introduced loving-kindness meditation as a method to handle them. The final sessions were about trigger factors for habitual consumption

behaviour. Exercises were walking meditation and labeling thoughts and feelings. Finally, methods about maintaining absence of substance use were offered.
Each session had an overarching theme which were chronological automatic pilot and relapse, awareness of triggers and craving, mindfulness in daily life, mindfulness in high-risk situations, acceptance and skillful action, seeing thoughts as thoughts, self-care and lifestyle balance and social support and continuing practice.

In addition, the studies by Kober et al. (2017), Abed (2019) and Glassner (2017) were tailored to the specific drugs, which were tobacco, heroin and cocaine. Adjustments were related to drug specific trigger factors for habitual consumption, as well as maintaining absence from substance use.

In all studies, sessions started with 20 to 30 minutes of guided meditation involving experiential exercises, partly followed by discussing the role of mindfulness in relapse prevention, and were closed by allocation of homework exercises that covered a body scan, monitoring of daily cravings and mood, walking meditations and mindfulness of breath.

Mindfulness-Based Stress Reduction

While MBRP was the predominant intervention in the studies included in this review, MBSR was applied in two studies. Both differed in content, duration and timespan. Therefore, the treatment carried out by Yadav (2017) consisted of daily body scan meditations for 45 minutes, followed by 15 minutes discussion in a time span of one week. On the other hand, Fahmys' et al. (2019) intervention covered four sessions a week over a period of one month. The sessions were about either formal or informal exercises, coupled with mindfulnes psychoeducation. Formal exercises included audio recorded meditation techniques which were mindful breathing and sitting, body scan, loving-kindness and mindful self-inquiry. Informal exercises consisted of mindful daily-life activities (e.g., Eating), stress management as well as the RAIN (Recognize, Acknowledge, Investigate and Non-identify) technique, a method which is characterized by maintaining awareness of surroundings. Thereby, the aim is to accompany occuring thoughts and feelings without judgement.

Control interventions

Davis et al. (2018) used a 12-step approach that was combined with CBT and supplemented by eight extra alcoholics and Narcotic Anonymous social support groups. Zemestani et al. (2016) also used a 12-step format. Elements were psycho-education,

practicing rational thinking skills and learning about effects that substance use has on social relationships. Relapse prevention skills were also included and inspired by Gorskis' (2007) disease model of addiction. Fahmy et al. (2019) applied TAU as well, however their approach was more medication oriented. Individuals received mood stabilizers, antipsychotics and sedatives for treating symptoms during withdrawal phase. In addition, group therapies, motivational groups and CBT were included.

Whereas the studies mentioned above included cognitive-behavioral techniques as part of their TAU, Bowen et al. (2014), Carroll & Lustyk (2018) and Kober et al. (2017) distinguished CBT from TAU explicitly. Thus, Bowen et al. (2014) applied TAU by using the 12-step program for alcoholics and narcotics in weekly groups for 1,5 hours each session and recovery oriented discussions as a central element. Moreover, they applied a CBT which was similar to MBRP in terms of time, format, homework and location. Main part was practicing cognitive behavioural coping skills, goal setting, assessing and evaluating high-risk situations, problem solving, self-efficacy, and social support. Individuals also monitored mood and craving.

Like Bowen et al. (2014), Carroll and Lustyk (2018) also used TAU and CBT separately. While their TAU consisted of the regular 12-step program from the community treatment agency, their CBT exclusively covered cognitive behavioral strategies, for example urge surfing. Beside MBRP, Kober et al. (2017) assigned participants to the freedom from smoking (FFS) intervention, designed by the American Lung Association. The overall topics were cognitive coping strategies for craving, stress and negative emotions, relapse prevention and behaviour modification. The intervention covered three stages (preparation, action and maintenance). The preparation phase consisted of three sessions in which the participants identified smoking patterns by self-monitoring, figured out trigger factors and developed a personal plan with aims about quitting smoking. In the action stage, consisting of one sessions, participants worked on individual strategies for coping with stress and craving. Finally, the maintenance stage covered 4 sessions carried out with the overarching topic of identifying ways to remain smoke-free by incorporating a healthy lifestyle. After each session, homework exercises were handed out, including formal (f.e. guided relaxation) and informal (f.e. smoking diaries) techniques.

Glassner et al. (2017) combined MBRP contingency management and compared to a control group receiving contingency management and health education, which were eight,

weekly psychoeducation sessions adressing health and wellness topics, f.e. nutrition, physical activity and acupuncture.

Research Results

For each study, pre- and post-intervention assessments have been conducted as outcome measures. Seven studies also included follow-up measures which differed in frequency and total lenght, reaching from one week, up to twelve months. The measures adressed substance intake and factors that support build up and maintenance of an addiction (e.g. stress levels, craving and depressed mood)

Impact of MBT on substance seeking and intake

Studies by Davis et al. (2018); Grow et al. (2015) and Bowen et al. (2014) could prove significant reductions of drug intake or drug seeking. First of all, Grow et al. (2015) used MBRP as a treatment for people abusing one or more substances out of alcohol, stimulants, opiates and cannabis. They figured out two main findings: (1) they observed an inversed correlation between home practice of mindfulness exercises and frequency of substance use, and (2) measured a significant decrease of substance use from baseline to post-intervention, whereby the decrease plateaued at the 4-monthly follow up.

Abed & Shahidi (2019) also used MBRP as a treatment for exclusively heroine misuse. According to urine analyses at the 1-month follow up, 9% of all people who received MBRP had positive drug tests. Up to the 3-month follow up, the ratio of positive tests increased to 14%. Bowen et al. (2014) measured long-term effects of MBRP regarding drug intake and heavy drinking. Overall, with each follow-up measure in periods of 3 months, 6 months and 12 months post intervention drug use and heavy drinking decreased constantly.

Impact of MBT on addiction related mechanisms

In total, nine studies measured at least one addiction related factor which were craving, perceived stress levels, anxiety, depressed mood, self-control, distress tolerance and impulsive behavior. All studies showed a decrease of craving post-intervention and during respective follow-up measurements.

Abed & Shahidi (2019) conducted pre- and post-treatment measures of craving by using the five subscales of the heroin craving questionnaire (HCQ). For the experimental group, the findings showed significant decreases on the subscales 'desire to use', 'intention to use' and 'anticipation of relief from withdrawal or dysphoria'. Craving was also measured in

context of comorbid mood disorders and emotional states. Results by Zemestani & Ottaviani (2016) showed a significant decrease of craving post-treatment and maintaining in follow-up measures for participants assigned to MBRP.

Yadav (2017) conducted a single case study in which daily body scan meditations were applied as part of a MBSR treatment programme. The treatment proved benefits with regard to decreased craving scores after one week of meditation exercises.

Glassner et al. (2017) measured anxiety and depression in participants with stimulants abuse. Both decreased constantly in the MBRP group from baseline to the 16-week follow-up.

Comparison of MBT with control groups

Treatment benefits of studies by Davis et al. (2018) and Zemestani et al. (2016) were made for declines in stress levels, craving and substance use could be identified for participants assigned to MBRP and TAU. However, treatment effects were stronger for people who received MBRP. Moreover, Davis et al. (2018) found differences over time when comparing MBRP with TAU. Accordingly, after a decrease from baseline to the post-treatment measure in both groups, the TAU group showed immediate increases plateauing after 13 weeks, while MBRP participants abstained.

Also Bowen et al. (2014) found significant differences in heavy drinking days and use of any drugs between MBRP, TAU and CBT. Post-intervention, as well as follow-up measurements could figure out significant treatment benefits of MBRP and CBT compared to TAU. Participants who received CBT were less likely to use drugs at follow-ups after 3- and 6 months compared to MBRP. However, until the 12- month follow up, drug use increased for the CBT group. In contrast, drug use of people assigned to MBRP decreased constantly and were significantly below the CBT group level. The same could be observed regarding heavy drinking days. While the CBT group showed increases between 6- and 12 months post-intervention, the MBRP group decreased drinking behavior constantly in the long-term.

Fahmy et al. (2019) conducted baseline and post-intervention (MBSR and TAU) measures of distress tolerance and impulsive behaviour for opioid dependent participants. Both intervention groups increased in their scores on all subscales (tolerance, appraisal, absorbtion and regulation) of the distress tolerance scale (DTS), whereby increases were higher for the MBSR group. Taking the Impulsive behaviour scale (UPPS-P) into account, participants assigned to MBSR especially decreased in negative urgency scores, indicating a lower tendency to overreact in negative emotional states. In contrast, the TAU group

decreased in sensation seeking. Furthermore, a stress test after treatment showed a decreased activity of right superior and right inferior frontal cortex in MBSR patients.

Carroll & Lustyk (2018) compared treatment effects of MBRP, CBT and TAU on a present moment state of craving and anxiety by using the Visual Analogue Scale (VAS) while confronting the participants with the PASAT as a cognitive stressor. From baseline to stressor, the findings showed slight increases in craving for the CBT group and high increases for the TAU group, while participants assigned to MBRP maintained their baseline level of craving. The similar pattern could be observed for anxiety. In addition, an increase in heart rate frequency was measured for all treatment groups, whereby the CBT group had the lowest, and the TAU group the highest increase.

Another study about participants reactivity to stressors was carried out by Kober et al. (2017). The researchers measured neural reactivity during stressful scenarios. Participants who received MBT did not show increases in reactivity in any brain region, whereas CBT participants showed increased reactivity.

Finally, Glassner et al. (2017) compared anxiety, addiction severity, emotion regulation and depression in groups who received MBRP or health education. From baseline to post-intervention, decreases in anxiety, addiction severity and depression, as well as increases in emotion regulation were respectively in favor of MBRP. In addition, weekly follow up measurements of depression could identify constant decreases for the MBRP group until the 16-week follow-up.

Study (by date)	Aims	Instruments	Sample	Procedure	Results
Davis et al. (2018)	Comparing the effectiveness of TAU and MBRP on stress, craving and substance use	PSS GAIN SFS	N= 79 MBRP (n= 44) TAU (n=35)	Participants were randomly assigned to receive MBRP or TAU. Follow-up assessments conducted bi-monthly for self-reported measures of stress (PSS), craving (GAIN) and substance use (SFS)	Compared to TAU, participants from the MBRP group showed declines in stress levels and levels of craving and substance use at each point of time
Grow et al. (2015)	Investigating the relationship between treatment enactment, AOD and craving in the context of MBRP	PACS: Penn Alcohol Craving Scale TLFB: Timeline Followback	N= 93	Participants were randomized to receive 8 weeks of MBRP or continue their standard aftercare group therapy. Assessments were at baseline, post-intervention, 2-monthly and 4-monthly) for measuring AOD use, craving, and extent of home mindfulness practice	MBRP participants increased amount of time with home mindfulness practice. Home practice associated with less AOD use and craving
Bowen et al. (2014)	Comparing long-term efficacy (substance use) of MBRP, cognitive behavioral relapse prevention and TAU during a 12-	ASI: Addiction Severity Index SDS:	N= 286 MBRP: n= 103 RP: n= 88 TAU: n=95	Participants were randomly assigned to receive 8 weekly group sessions of MBRP, cognitive behavioral relapse prevention, or TAU. Follow-up assessments of relapse, heavy drinking and frequency of substance use at baseline, 3-,6-, and 12-month follow	Participants assigned to MBRP and cognitive behavioral relapse prevention showed lower risk of relapse to substance use and heavy drinking than the TAU group. Among those who relapsed, significantly fewer days of substance use

	month follow-up period	Severity of Dependence Scale calendar-formatted Timeline Follow-back		up points. Measures included self-report of relapse, drug urinalysis and alcohol screenings	and heavy drinking at the 6-month follow-up. RP showed an advantage over MBRP in time to first drug use. At the 12-month follow-up, MBRP participants reported significantly fewer days of substance use and significantly decreased heavy drinking compared with RP and TAU
Yadav (2017)	Investigating the effectiveness (substance use) of body scan meditation of MBSR on craving in patients with alcohol dependence	PACS CIVA-Ar SADQ	N= 1	Participant completed a MBSR treatment programme with daily 45-minutes guided body scan meditations and 15 minutes discussion for one week. Follow-up assessments for measuring craving, severity of alcohol dependence and alcohol withdrawal at baseline and after one week of treatment	Decrease in craving scores from pre-assessment after one week of body scan meditation in patients
Zemestani and Ottaviani (2016)	Comparing the efficacy of MBRP and TAU in diminishing craving, depression and anxiety symptoms among substance	BDI-II BAI PACS	N= 74 MBRP: n= 37 TAU: n= 37	Participants randomly assigned to receive MBRP or TAU. Follow-up assessments for measuring depression, anxiety, and craving at baseline, post-intervention and at a 2-month follow up	Lower post-intervention rates of depression, anxiety, and craving in those who received MBRP as compared to those in TAU

	abusers in an inpatient treatment setting				
Fahmy et al. (2019)	Investigating clinical and neural effects of MBT in patients with opiate dependence during the first month of abstinence	ASI: addiction severity index FMI: Freiburg mindfulness inventory DTS: Distress Tolerance Scale UPPS-P: Impulsive Behavior Scale	N= 32 MBT: n= 16 TAU: n= 16	Participants randomly assigned to the treatment groups MBT+TAU and TAU only. Follow up assessments for measuring mindfulness practice, distress tolerance and impulsive behaviour	Both groups increased in mindfulness, with more increase for the MBT group. Also both groups increased in distress tolerance, where MBT increased more on subscales appraisal, absorption and regulation Both treatment groups decreased in impulsive behaviour. While participants who received TAU decreased more on positive urgency & sensation seeking, the MBT group decreased more on negative urgency, lack of premeditation and lack of perseverance
Carroll and Lustyk	Comparing the effects of MBRP, RP and TAU on stress in	STAI-S/STAI-T: State-Trait	N= 34 MBRP: n= 12	Participants randomly assigned to 8 weeks of MBRP, **cognitive based RP**, or TAU. Then, measuring anxiety and craving from	Both, anxiety and craving increased from baseline to stressor for all treatment groups. MBRP had the lowest increase

(2018)	substance addicted people (alcohol, crack cocaine, marijuana, methamphetamine, heroin)	Anxiety Inventory PASAT: Paced auditory serial addition task (cognitive stressor) VAS: Visual Analogue Scale (craving)	RP: n=12 TAU: n= 10 Primary drug: alcohol: n= 20 crack cocaine: n= 8 cannabis: n= 1 Methamphetamine: n= 3 Heroin: n= 2	baseline and after participants were confronted with a cognitive stressor	while TAU had the highest.
Kober et al. (2017)	Comparing the effect of MBT with **cognitive behavioural** strategies on stress reactivity in smoking	Stress Task fMRI	N= 23 MBT: n= 11 **CBT**: n= 12	Participants randomly assigned to either CBT or MBT for 2 weekly group sessions for 4 weeks. Follow up assessment for measuring neural reactivity during a stress task	MBT group did not show greater neural reactivity in any region during stressful scenarios. CBT group showed increased neural reactivity in brain regions (left amygdala, anterior, middle, and posterior

	addicted people				insula, and bilateral portions of parahippocampal gyrus and hippocampus, putamen, thalamus, midbrain and cerebellum
Abed and Ansari (2019)	Investigating the effect of MBRP in reducing lapse and craving in heroine addicted people undergoing Methadone Maintenance Therapy	HCQ: Heroin Craving Questionnaire	N= 55 MBRP: n= 26 Control group: n= 29	Participants pre-tested heroin use, followed by random allocation into an 8-weekly MBRP intervention or a no-intervention group. Follow up assessment measuring post-test heroin use	Desire and intention to heroin use decreased in MBRP group
Glasner et al. (2017)	Investigating the effects of MBRP, relative to a health education control condition (HE) among stimulant dependent adults receiving contingency management	ASI: Addiction Severity Index BDI: Beck Depression Inventory DERS: Difficulties in Emotion Regulation	N= 63 MBRP: n= 31 HE: n= 32	Participants randomly assigned for a 12-week intervention phase to either CM+MBRP or CM+HE. Repeated assessments at baseline, weekly during the 12-week intervention phase, and at 1-month follow-up measuring addiction severity, depression, difficulties in emotion regulation and anxiety	MBRP compared to the HE group: anxiety decreased to a greater extent over time, addiction severity improved more significantly over time, participants had less problems with emotion regulation and depression more decreased

		Scale BAI: Beck Anxiety Inventory

AOD, Alcohol and other Drug; CBT, Cognitive Behavioural Therapy; CM, Contingency Management; HE, Health Education; MBRP, Mindfulness-Based Relapse Prevention; MBRS, Mindfulness-Based Stress Reduction; MBT, Mindfulness-Based Therapy; MT, Mindfulness Training; RP, Relapse Prevention; TAU, Treatment As Usual;

Discussion

This review aimed to explore the effectiveness of MBT in treating individuals with SUD in different categories of substances such as alcohol, tobacco, stimulants, opioids and cannabis. In addition, a comparison with control conditions, especially TAU and CBT, served to figure out which approach is the most effective in terms of decreasing relapse rates, but also with regard to psychological factors such as craving, experiencing and dealing with depressive mood, anxiety and stress. Thereby, differences in short- and long-term effectiveness of all approaches, became obvious. Furthermore, by including studies from the USA, Egypt, Iran and India, first impressions about effectiveness of MBT in different cultures could be gained.

All of the reviewed studies provided significant evidence for the effectiveness of MBT.

Most studies of this review included at least one of the following factors, becoming relevant either in MBRP or MBSR: craving, anxiety, stress and depressed mood as predictors for relapse and working on diminishing these by practicing and applying the coping skills “direct attention to the present moment” and “developing an accepting attitude”. In literature, this procedure is supported by a variety of research. According to Mallik et al. (2021), increasing non-judgmental awareness of internal cues that trigger craving and relapse reduces craving-related distress and thus, break up the link between craving and substance use.

Compared to CBT and TAU, MBTs put a stronger focus in adressing clinical variables (e.g. state of depression; anxiety) and inner processess (e.g. craving; stress levels; levels of self-control) as substance abusing factors (e.g. through practicing how to direct their attention to the present moment when experiencing craving and negative emotions (MBRP), or through practicing mindful breathing and bodyscan exercises to reduce stress levels (MBSR)).

A recently published systematic review about effectiveness of MBRP in SUD by Ramadas et al. (2021) put emphasis on clinical variables. For most of the reviewed studies, they identified treatment benefits of MBRP on at least one SUD or one clinical variable. They concluded an interaction between affective symptoms and coping mechanisms. Therefore, a reduction of symptoms is connected to more favorable substance use. Consequently, MBRP would be escpecially helpful for people with comorbid affective disorders (Roos et al., 2020).

In the long-term, especially MBT had the lowest relapse rates compared to other approaches (including CBT and TAU). Accordingly, TAU included psycho-education, rational thinking skills but also pharmacotherapy like mood stabilizers, anxiolytics, disulfiram

and antipsychotics. The relapse prevention skills were built on Gorskis' Cenaps model of addiction implying the point of view that an addiction is labeled as a disease (Gorski, 2007). Thus, to a certain degree, focusing on SUD pathology were part of TAU which is a contrast to a positive psychological point of view (Seligman & Csikszentmihalyi, 2014).

The CBT approaches used in the studies were more problem solving oriented. Relapse prevention programmes were about figuring out trigger factors for stress, craving and negative emotions and aimed for diminishing these. Also individual strategies for coping with stress and craving were practised. MBRP programs as the main treatment of this paper showed similarities to CBT in terms of practicing skills for high-risk situations in which addiction supporting triggers were tackled. The main difference between these treatments was in the ideal that focusing strenghts take a bigger part of treatment than focusing problems. Thus, participants learned to develop an accepting attitude, direct attention to present moment experience, even if craving or negative emotions were included. Acceptance served as a main tool for coping with negative emotions. Extracting three expressions 'tackling pathology', 'diminishing problems' and 'promoting strenghts' as characteristics to the three treatment forms it turned out that focusing on strenghts is more effective than focusing problems or treating addiction as a disease. The findings can also be seen as an affirmation of a mixed methods pilot study by Krentzman & Barker (2016) investigating counselors' perspectives of Positive Psychology for the treatment of addiction. Due to them, negative thinking and negative mood are deeply connected with the process of addiction and central to frameworks that explain substance use and relapse. Although TAU and CBT promote a state, free of drug use they do not counteract negative thinking patterns effectively, keeping the individual with an attitude substance use supporting. In contrast, positive psychological interventions would mediate hope and optimism, fostering self-acceptance and self-esteem and thus, disrupt this negativity (Krentzman & Barker, 2016). This could also be attested for long-term benefits of mindfulness based therapies and CBT compared to TAU. Findings showed advantages in terms of lower depression relapse, anxiety symptoms and substance use. Remarkable is that partly, CBT showed slight advantages over MBT within the early months after the intervention, however in the long-term after 12 months only MBT showed constant abstinence of substance use.

One of the most important outcomes was that in short-term MBT is more beneficial than TAU and almost equally effective as CBT, but in the long-term it is superior to all of the

included interventions. This is in line with a variety of further research. Therefore, according to Brand et al., (2012) long-term meditation experience is associated with improved sleep and a decrease of cortisol levels. Notable is that the cortisol levels did not change between the beginning and end of individual MBSR sessions. In addition, Lykins & Baer (2009) reported benefits for long-term mediators, being more mindful in everyday life and scored higher on reflection, self-compassion and well-being and lower on maladaptive variables like rumination, thought suppression and emotion regulation than short-term mediators.

Findings by Bowen et al. (2014) indicated notable differences between CBT and MBT in the long-term. Participants who received CBT were less likely to use drugs at follow-ups after 3- and 6 months compared to MBRP. However, until the 12- month follow up, drug use increased for the CBT group, whereas drug use of people assigned to MBRP decreased constantly and were significantly below the CBT group level. This discrepancy in long-term effects might be explained by the individuals' improved ability to notice and accept discomfort connected with craving or uncomfortable feelings. Consequently, mindfulness can be considered as a skill that grows and unfolds its potential over the course of time.

Strenghts

One strenght of this review is that it is not restricted to substance use as the only indicator for the effectiveness of treatment programmes. Therefore it goes beyond the finding that MBT is more effective than TAU because of lower using/drinking days. The review emphasizes other SUD mechanisms like craving and co-morbid symptoms like stress, anxiety and depression as underlying addiction-related factors. In addition, the current review highlights respective conceptualizations of the interventions. It shows differences, namely positive psychological ideals of mindfulness and the consideration of psychological factors against the contrasting pathological, disease oriented approaches of TAU.

Limitations

In the course of the study, the informative value of the data has to be considered as limited in terms of differences in quality of the reviewed articles. First of all, this paper is limited by only ten studies restricting the significance.

In addition, the studies differed regarding the *categories of substances*. In only half of the studies, interventions were tailored to one specific category like opioids, stimulants, alcohol and tobacco, while the rest of the articles were focused on either mixed different

drugs or gave no information about the kind of drug (e.g. legal or illegal substances/drugs). This might be a limitation for the results, because each drug can be characterized by it's individual mechanisms, states of intoxication and course of addiction making tailoring of interventions to the kind of drug necessary.

Another limitation might be the use of the *mindfulness concept (MBT)*. On the one hand it might be a strenght to use the concept as broad as possible to investigate the general effectiveness of mindfulness practices. On the other hand it also makes the results less specific, because different intervention programmes like MBRP, MBSR and MT are put into the same category (MBT).

Future Research

This review offers indications that MBT is an approach that proves effectiveness for different categories of substances. However, data are still incomplete. Consequently, future research should differ more between categories of substances as data was only available for opioids, stimulants, cannabis, alcohol and tobacco, while there was no information about effectiveness of MBT for hallucinogens, inhalants, sedatives, hypnotics and anxiolytics. In addition MBT seemed to be applicable for people from the USA, Iran, Egypt and India. However SUD varies depending on the country, for example the prevalence of alcohol use disorder is higher for eastern european countries than for the middle east (Degenhardt et al., 2018). Another aspect that could be interesting for future research is a comparison between different MBTs. Up to now, the predominant proportion of studies were about MBRP while there is a lack of data about MBSR and MBCT.

Conclusion

According to the studies included in this review, the application of MBT for treating SUDs is superior compared to other treatment approaches (e.g. TAU, CBT). Interventions treating addictions as a disease and focusing on the psychopathological aspects of the disorder were less effective than approaches promoting present moment experiences and acceptance as main tools for coping with negative emotions (MBT). Interestingly, CBT had similar short-term effects like MBT. Both treatment approaches had as common ground drug craving, stress, depression and anxiety symptoms. However, MBTs were superior to CBT regarding the long-term effects as depicted by follow-ups.

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