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Mindfulness-based interventions for patients with schizophrenia spectrum disorders: A systematic review of the literature

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ABSTRACT

Background: Mindfulness-based interventions (MBIs) have emerged as secular practices, including elements of mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT). While MBIs have been widely adopted for physical and mental illness, only a few available programs are explicitly adapted for psychosis. However, previous reviews have reported the vital heterogeneity regarding treatment program structure. Therefore, this review aims to compare the structure of different mindfulness protocols applied to patients with schizophrenia spectrum disorder (SSD).

Methods: A systematic search was conducted up to March 2023 in PubMed, Embase and PsycInfo. Following our protocol (CRD 42023253356), we followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) checklist.

Results: We included 22 randomized controlled trials (RCTs) involving 1500 patients SSD. All programs varied in structure, session components, duration, and instructor experience. While MBSR-like programs focused on stress reactivity, MBCT-like programs addressed primary symptoms of psychosis and relapse prevention. Despite the heterogeneity of programs, some common mechanisms emerged, including attention training, emotion and stress regulation, decentering, self-compassion, and cognitive restructuring.

Conclusions: The critical heterogeneity found limits the interpretation of results. However, most recent trials present fewer risks of bias and more homogenous programs. Findings suggested potential benefits, such as reduced negative symptoms, increased well-being, and decreased hospitalization rates. For future studies, authors should align on more congruent MBIs programs for patients with SSD. Further research is needed to identify optimal mindfulness teaching approaches for patients with psychosis and investigate specific mechanisms of action, relevant processes, and optimal doses in varying settings.

1. Introduction

In the recent decades, meditation has garnered widespread popularity in Western cultures, and there has been a burgeoning interest in its potential therapeutic effects for diverse medical conditions. Although initially regarded as a religious or spiritual practice aimed at alleviating suffering, secular approaches such as mindfulness-based interventions (MBIs) have arisen, alongside other mind-body practices like yoga and transcendental meditation (Louise et al., 2018). The initial MBI introduced was mindfulness-based stress reduction (MBSR), an evidence-based program developed in the 1970s. This eight-week program offers comprehensive mindfulness training designed to aid individuals in

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managing stress, anxiety, and pain (Kabat-Zinn, 2005). Subsequently, another widely adopted program targeting depression relapse, mindfulness-based cognitive therapy (MBCT), was developed (Williams et al., 2008). More recently, small clinical trials have been conducted for patients with psychosis (Chadwick et al., 2005; Chien and Lee, 2013; Langer et al., 2012). According to international guidelines for patients with psychosis, psychosocial interventions in adjunction to pharmacological options are one of the most effective supplementary treatments to antipsychotics (Gaebel et al., 2020; Galderisi et al., 2021), Especially concerning residual symptoms or symptoms necessitating additional medical attention, such as negative symptoms, there exists a distinctive gap. Unlike MBCT for depression, MB-Cancer for cancer relapse, or MB-Eat for eating disorders, no broadly accessible and transculturally validated program is directly tailored for psychosis. This disparity could be attributed to apprehensions that mindfulness might exacerbate psychosis, even though an expanding body of literature showcases its efficacy in mitigating distress and enhancing overall functioning (Böge et al., 2021b; Hodann-Caudevilla et al., 2021; Sabe et al., 2019). Recent research has discovered no correlation between meditation practice and a worsening of psychotic symptoms. Authors have consequently deduced that incorporating mindfulness-based interventions into the daily lives of individuals with this disorder is deemed safe (Austin et al., 2013; J.E. Jansen et al., 2020).

In recent years, more than a dozen of systematic-reviews and meta-analyses have been conducted to examine the effects of third-wave therapies on positive or negative symptoms in patients with psychotic disorders displaying considerable scientific interest in this research field (Cramer et al., 2016; Hodann-Caudevilla et al., 2020; J.E. Jansen et al., 2020; Sabe et al., 2019). Nevertheless, up to the present day, cognitive-behavioral therapy remains the sole psychotherapeutic recommendation for treating psychosis. Regrettably, there exists an absence of qualitative scrutiny regarding the intricacies of mindfulness-based intervention programs and the efficacy of diverse program parameters. Thus, the current review exclusively concentrates on protocols employing randomized controlled trials (RCTs) with mindfulness-based approaches as the core treatment for individuals with psychosis, in conjunction with standard treatment.

The objective of this systematic review is to compare various mindfulness protocols utilized with patients experiencing psychosis. Drawing from published findings, we intend to investigate the most efficacious interventions for individuals dealing with psychosis.

2. Methods

2.1. Registration

This work was prepared according to Preferred Reporting items for Systematic reviews and Meta-Analyses (PRISMA-P) guidelines (Page et al., 2021). In March 2023, the protocol of this study was published in the International Prospective Register of Systematic Reviews (PROSPERO CRD42023253356). The PRISMA checklist can be found in the supplement.

2.2. Outcomes

Our main focus was to juxtapose the structures of the diverse Mindfulness-Based Interventions (MBIs) employed in the selected trials. This encompassed aspects such as the type of mind-body exercises incorporated, alignment with the MBSR or MBCT framework, and the cumulative hours dedicated to meditation. As a secondary goal, we aimed to pinpoint the mechanisms or processes linked to the enhancement of varied health-related results (e.g.; changes in positive and negative scores, depression scores, functioning, mindfulness, acceptance, prevention of relapse, and hospitalization).

2.3. Search strategy

We undertook an extensive literature search encompassing the EMBASE, PubMed, and PsychINFO databases up until March 31, 2023, with no limitations on the publication dates. Additionally, in our pursuit of pertinent articles, we scoured clinical trial registries, including ClinicalTrials.gov and clinicaltrialsregister.eu. Employing a blend of free-text keywords and MeSH terms, we devised a strategy to extract the utmost quantity of articles for initial evaluation, following the approach elucidated by Ho and colleagues (Ho et al., 2016). We employed the subsequent keyword combinations: (schizo* OR psychosis OR psychotic) AND (mindfulness OR meditation OR “mindfulness-based intervention” OR MBI). Solely articles written in English were retained for further analysis. To identify and eliminate duplicates, a citation manager (Mendeley) was utilized. Moreover, we scrutinized the reference lists of the retrieved articles to augment the electronic exploration. For inclusion in this review, only articles discussing mindfulness-based programs with a particular emphasis on mindfulness meditation were taken into account. Conversely, articles centered on Acceptance and Commitment Therapy (ACT), which does not encompass group meditation and does not qualify as a mindfulness-based intervention, were excluded.

2.4. Inclusion criteria and study selection

For inclusion in the analysis, studies had to meet the subsequent criteria: (a) being randomized controlled trials (RCTs); (b) presenting data concerning patients diagnosed with a schizophrenia spectrum disorder (SSD); (c) conducting a comparison between mindfulness-based interventions and a non-specific control intervention or treatment-as-usual; (d) providing results in the English language. Reviews, pilot/single dose studies, case reports, and case series were not considered (Fig. 1). Additionally, cross-over RCTs were excluded due to the uncertainty surrounding carry-over effects of the considered mind-body therapies. All pertinent information was extracted independently by two authors (RK, NP) following a pre-defined data extraction template. Studies that were excluded along with the reasons for their exclusion are documented in the Supplementary materials.

2.5. Risk of bias

We assessed the risk of bias among included studies using the Cochrane Collaboration risk of bias assessment for included RCTs.

3. Results

3.1. Search results and qualitative description of the included articles

A total of 491 unique articles were identified. After screening the abstracts and trial protocols, we excluded 436 articles, leaving 59 articles for full-text review to determine eligibility. We identified 22 distinct trials that included a total of 1500 patients who were treated with antipsychotic medication for schizophrenia or a related disorder diagnosed using the DSM criteria (refer to Table 1) (Böge et al., 2021a; Çetin and Aylaz, 2018; Chadwick et al., 2009, 2016; Chien et al., 2017; Chien and Lee, 2013; Chien and Thompson, 2014; Davis et al., 2015; Ellett et al., 2020; Halverson et al., 2021; Lam et al., 2020; Langer et al., 2012; Langer et al., 2020; Lee, 2019; López-Navarro et al., 2015, 2022; Macdougall et al., 2018; Moritz et al., 2015; Özdemir and Kavak, 2022; Shen et al., 2021; Shieh et al., 2018; Tang et al., 2021). All studies included stabilized outpatients except for two studies, including inpatients (Böge et al., 2021a; Ellett et al., 2020). Of the included studies, 52.6 % of patients were male, and the mean age of patients was 35.9 years. The first published study included was Chadwick et al., 2009, a randomized feasibility trial on mindfulness groups for patients with distressing voices and paranoia (Chadwick et al., 2009). One study on inpatients with psychotic symptoms was excluded as the protocol used ACT in

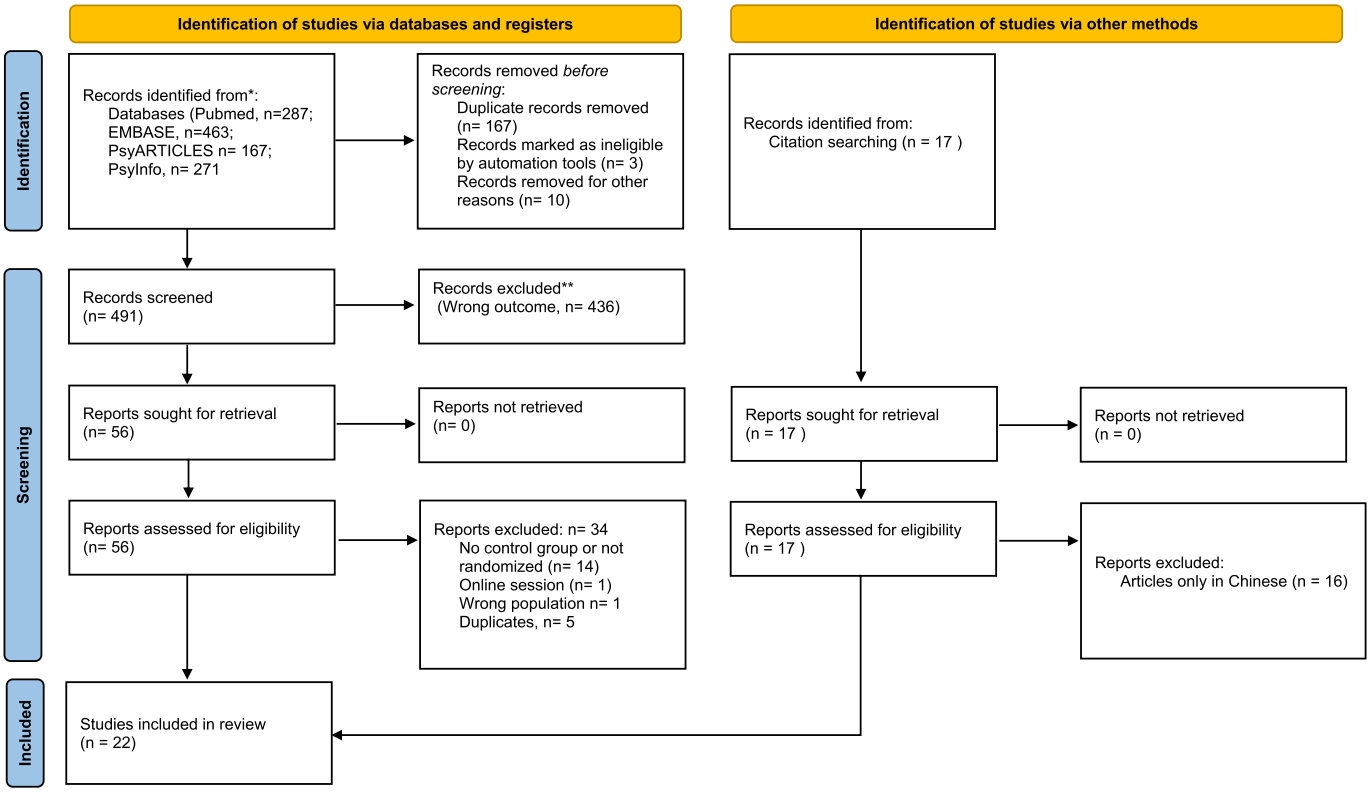

Fig. 1. Flow chart.

individual sessions (Gaudiano et al., 2013). Additionally, an uncontrolled study proposing online MBIs to patients with psychosis was excluded (Shore et al., 2018), as well as a trial focusing on patients at high risk for schizophrenia (Hafeman et al., 2020). Overall, 33 studies were not retained, particularly 17 from Chinese authors that were unavailable in English or not randomized (Tao et al., 2021). The complete list of studies with reasons for exclusion is reported in the supplement (Supplementary Table 1).

3.2. Differences in program design between retained mindfulness studies

All the studies that met the inclusion criteria employed distinct names and frameworks for their interventions. In certain trials, the programs were not even specifically tailored for individuals with psychosis (Table 2). Taken globally, the details of the program furnished by the authors were very dissimilar (Supplementary Table 2). In contrast, two studies from the same research group designed a specific program for patients with persecutory delusions (Chadwick et al., 2009; Ellett et al., 2020), while other research groups focused primarily on inpatients with SSD with acute exacerbations (Böge et al., 2021a) or first-episode of psychosis (Langer et al., 2012; Macdougall et al., 2018). MBIs were divided into two types of programs: MBSR-like and MBCT-like, which were adapted versions of both MBSR and MBCT programs.

We included 9 studies with MBSR-like programs and 13 studies with MBCT-like programs (Table 2). For both MBSR and MBCT programs, the meditation length was reduced, as recommended by Chadwick and colleagues for patients with SSD (Chadwick et al., 2009). More MBCT than MBSR programs have appeared in the last decade (Supplementary Fig. 1). The average program length was 18.4 h, with MBSR-like programs averaging 21.1 h (range 9.3–40) and MBCT-like programs averaging 16.8 h (range 8–24). However, we could not estimate hours of practice for each study due to insufficient information. Furthermore, certain programs were conducted on a daily basis (Shen et al., 2021), while others held biweekly sessions (Chien and Lee, 2013; Chien and Thompson, 2014; Davis et al., 2015; Çetin and Aylaz, 2018). However, the remaining studies uniformly offered weekly sessions. Furthermore, although seated mindfulness meditation emerged as the most frequently employed form of meditation, a number of trials also incorporated yoga sessions or other mindfulness-based movements. The precise count of sessions also exhibited variations across studies, with some adhering to the traditional 8-week program (one session per week), while others introduced a greater number of sessions but of shorter duration (Table 2). Although there was a lack of uniformity in reporting this information, it's important to highlight that most of the participants enrolled in the studies were novices in terms of engaging in mind-body practices. The level of experience among mindfulness instructors exhibited significant variation across the included studies. Notably, only a single study specified that the meditation instructor had undergone formal training in mindfulness at the Center for Mindfulness at the University of Massachusetts Medical School (Davis et al., 2015). In most studies, instructors were nurses, psychologists, psychotherapists, or members of medical teams (Table 2). While most of the instructors had previous experience with psychosis, only six studies mentioned that the instructor had prior experience with mindfulness teaching for at least one year (Böge et al., 2021a; Chien et al., 2017; Davis et al., 2015; Langer et al., 2012; López-Navarro et al., 2022). In other studies, instructors only benefited from one MBSR cycle or a few hours of training before teaching mindfulness to patients (Table 2).

3.3. Risk of bias among included studies

Only a few numbers of studies presented a low risk of bias score (bias score ≥ 5) (Supplementary Table 3). In most studies, the randomization process and the blinding assessment were not clearly detailed. However, another critical bias was the qualification of the mindfulness instructor that widely differed between studies, as the evolvement/implication of the first/last author in the supervision or implementation/conduction of the mindfulness sessions (allegiance bias) (Table 2).

Table 1
Characteristics of included studies.

Study	Type and duration of trial	Key inclusion criteria//Type of protocol	Study arms	Inclusions (male %) Mean age (mean ± SD)	Key findings
1-Chadwick et al., 2009 (UK)	5 weeks single-blind RCTs, waiting-list controlled study, no follow up.	Outpatients included all met DSM IV diagnostic criteria for schizophrenia, and all were on anti-psychotic medication.	MBIs group Waiting-list group	9 (n.a.) 41.6 ± 8.1 9 (n.a.) 41.6 ± 8.1	Findings on feasibility are encouraging and secondary analyses replicated earlier clinical benefits and showed improved mindfulness of thoughts and images, but not voices.
2-Langer et al., 2012 (Spain)	8 weeks single-blind RCTs, waiting list-controlled study, no follow up.	Outpatients included presented with a diagnosis of schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder (DSM-IV), with clinical stability according to the research team therapist.	MBCT group Control group	7 (51.1 %) 34.7 ± 8.2 11 (63.6 %) 33.9 ± 10.7	The MBCT group scored significantly higher than the control group in his ability to respond mindfully to stressful internal events.
3-Chien and Lee, 2013 (Hong Kong)	6 months, multicenter single-blind RCTs study. 18 months follow-up.	Outpatient with diagnosis of schizophrenia (DSM-IV) during the past 5 years, at least 18 years old. Mindfulness-based psychoeducation program was compared to a TAU arm.	MBPP group Usual care	48 (54 %) 25.3 ± 8.2 48 (56 %) 26.5 ± 8.9	Authors found that patients in the MBPP arm presented less symptom severity, illness insight, and length of rehospitalizations had improved significantly at the two posttests (3 and 18 months), but their functioning and number of rehospitalizations improved significantly only at the 18- month follow-up.
4-Chien and Thompson, 2014 (China)	24 weeks, multisite RCTs. Intention-to-treat design. 24 months follow up.	Outpatients with schizophrenia (DSM-IV), with a history of <5 years of illness, aged 18 years or older, spoke mandarin. This trial had three arms, the Mindfulness-based psychoeducation, the conventional psychoeducation, and the usual care arm.	MBPP group CPEP group Usual care	36 (55.6 %) 25.1 ± 6.3 36 (58.3 %) 25.8 ± 7.9 35 (57.1 %) 26 ± 8.5	The mindfulness-based psychoeducation group reported significantly greater improvements in psychiatric symptoms, psychosocial functioning, insight into illness/treatment and duration of readmissions to hospital over 24 months when compared with the other two groups.
5-López-Navarro et al., 2015 (Spain)	26 weeks, single-blind RCTs.	Outpatients with a diagnosis of schizophrenia, schizoaffective disorder, or bipolar disorder (DSM-IV). MBIs protocol. On stabilized antipsychotic medications for 4 weeks. Patients were of 18 to 65 years old. PANSS scale. No prior experience of mindfulness or yoga.	MBI group TAU	22 (86.4 %) 38.77 ± 7.46 21 (86 %) 38.73 ± 7.46	Data suggest mindfulness added to IRT may enhance psychological quality of life in people with severe mental illness from a public community center. Results also suggest that mindfulness may impact frequency and intensity of negative symptoms.
6-Davis et al., 2015 (USA)	16 weeks, non-blinded RCTs study	Included outpatients presented a diagnosis of schizophrenia or schizoaffective disorder confirmed by a Structured Clinical Interview for DSM–IV.	MIRRORS group Intensive Support (IS)	18 (17,9 %) 53.2 ± 6.1 16 (100 %) 50.1 ± 10.6	The MIRRORS group worked more hours each week on average and that this difference increased over time as well as having generally better work performance compared with the Intensive Support group. Results suggest a link between MIRRORS and higher levels of work performance and persistence in people with schizophrenia.
7-Moritz et al., 2015 (Germany)	6 weeks, single blind RCTs trial	Outpatients included were aged between 18 and 65, with a verified diagnosis of schizophrenia/psychosis (DSM-IV).	Mindfulness group PMR	38 (42 %) 38.11 ± 9.09 52 (42,3 %) 37.46 ± 10.15	No changes across time or between groups were noted for the Paranoia Checklist. Both conditions showed a decline in depressive and obsessive-compulsive symptoms at a medium effect size.
8-Chadwick et al., 2016 (UK)	12 weeks, single-blind RCTs, comparing PBCT to a TAU arm.	Outpatients included were aged between 18 and older, with a diagnosis of schizophrenia/psychosis according to the ICD-10 criteria. Group Person-Based Cognitive Therapy is compared to TAU arm. Of importance, patients presented distressing voice (residual positive symptoms).	PBCT TAU	54(50 %) 42 ± n.a. 54(50 %) 42 ± n.a.	Findings suggest PBCT delivered over 12 weeks effectively impacts key dimensions of the voice hearing experience, supports meaningful behavior change, and has lasting effects on mood.
9-Chien et al., 2017 (China/Hong Kong)	24 weeks, single-blind RCTs.	Outpatients with a diagnosis of schizophrenia (DSM-IV). Patients were stabilized on antipsychotic with no substance use disorders. Patients were aged from 18 to 64 years. PANSS scale. Patient had not practice mindfulness and/or other therapies in the past 2 years	MBPEG group TAU CPEG	114(63 %) 25.1 ± 6.8 114 (64.9 %) 26.0 ± 8.5 114 (61.4 %) 25.8(7.9)	Compared with TAU and CPEG, MBPEG improves remission and hospitalization rates of people with schizophrenia spectrum disorders over 24 months.
10-Çetin and Aylaz, 2018 (Turkey)	4 weeks single-blind RCT. Eight sessions, twice a week (8–12 patients per group).	Outpatients were included if they were aged between 18 and 65 years of age and diagnosed with schizophrenia according to DSM-5 criteria. Authors compared mindfulness-based education to a control group.	MBP Control	55(67.3 %) n.a. 80(68.7 %) n.a.	Mindfulness-based intervention has increased the cognitive insight and medication adherence of the patients in the experimental group.

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Table 1 (*continued*)

Study	Type and duration of trial	Key inclusion criteria//Type of protocol	Study arms	Inclusions (male %) Mean age (mean ± SD)	Key findings
11-Shieh et al., 2018 (China)	8 weeks, single-blind randomized controlled study, with 3-month follow-up period.	Adult outpatients were included. These patients presented a diagnosis of chronic schizophrenia (no diagnostic criteria were given by authors).	MBT Control	21(57.1 %) 49.3 ± 9.16 37(76 %) 54.43 ± 6.32	MBT attenuated negative symptoms and the general psychopathology of schizophrenia, and showed stable effects, but not for positive symptoms. The finding of differential effects of MBT on negative and positive symptoms might result from the different characteristics of psychotic symptoms, and points to the importance of future study on how MBT facilitates emotional and cognitive changes, and on how to revise MBT for patients with different characteristics.
12-Macdougall et al., 2018 (Canada)	12 weeks, single-blind RCT.	Outpatients aged from 18 to 35 years of from a prevention program for early psychosis were included (DSM-V diagnosis of primary psychosis of <3 years). Authors compared a group-MBI, the Mindfulness Ambassador Program to TAU.	 TAU	11(76.5 %) 23.71 ± n.a. 10(76.5 %) 23.71 ± n.a.	MAP is associated with a high degree of acceptability and has beneficial effects for depression and fatigue.
13-Lee, 2019 (Taiwan)	8 weeks, single-blind randomized controlled study. Follow-up period.	In and outpatients being diagnosed on the schizophrenia Spectrum. Exclusion of patients exhibiting psychotic symptoms. Patients were of 18 to 64 years old.	MBI group TAU	20(n.a.) 54.4 ± 6.3 30(n.a.) 51.1 ± 6.3	Mindfulness-based program was adapted for schizophrenia patient with a program based on a self-awareness, self-regulation, and self-transcendence model of mindfulness. Total of 12 h of practice on 8 weeks.
14-Lam et al., 2020 (Hong Kong)	8 weeks single-blind randomized controlled study	Included outpatients were adults aged 18–65 years old; diagnosed with schizophrenia-spectrum disorders according to the DSM-IV-TR.	MBPP Control	24(25 %) n.a. 22(23 %) n.a.	The MBPP appeared to be effective for improving emotion regulation, which will contribute to future large-scale RCT to confirm the treatment effects in more diverse groups of schizophrenic patients.
Jansen et al., 2020a (Chile)	8 weeks, single-blind randomized controlled study.	Included outpatients were diagnosed with early onset schizophrenia or its subtypes according to the DSM-IV-TR. Authors compared a MBIs, mindfulness treatment, to TAU. This study included patients at risk mental state.	MT TAU	13(62.5 %) 24 ± 4.98 13(95.2 %) 23.6 ± 4.5	Eight MBIs sessions adapted for psychosis but not specific for cognitive impairments may not be enough to achieve significant effects on cognitive dimensions.
16-Ellett et al., 2020 (Ireland)	6 weeks, pilot RCTs.	This study included inpatients with a diagnosis of schizophrenia spectrum disorder presenting during inclusion distressing persecutory delusions. Authors compared MBIs for TAU.	MBIs TAU	13(78 %) n.a. 14(78 %) n.a.	This pilot study showed it is possible to recruit and retain people with current persecutory delusions into a group mindfulness study and the intervention was found to be safe, acceptable, and to reduce depressive symptoms.
17-Halverson et al., 2021 (USA)	6 months, single-blind RCTs. 14 to 24 sessions, that were weekly or biweekly 3 months follow-up.	Included outpatients were age from 18 to 35 years old and presented criteria for schizophrenia spectrum disorder according to DSM-IV. Authors compared the integrated-coping awareness therapy to TAU.	ICAT (53 %) TAU 19 (53 %)	18(53 %) 23.6 ± 4.3 18(53 %) 24.9 ± 3.8	Results suggest I-CAT led to greater reduction in symptoms (i.e., overall, negative, and disorganized symptoms), increased observational mindfulness, increased endorsement of a sense of purpose in life, and preservation of work abilities and school social functioning compared with TAU.
18-Böge et al., 2021a,b (Germany)	12 weeks rater blinded RCT.	Included patients were treated psychiatric in-patients between 18 and 65 years of age, diagnosed with a schizophrenia-spectrum disorder according to DSM-5 and ICD-0 criteria.	MBGT+TAU TAU	22 (11 %) 37.7 ± 12.8 18 (13 %) 42.7 ± 14.1	MBGT appears feasible and acceptable for in-patient settings, with high protocol adherence and retention rates. Preliminary findings highlight a proof of concept of MBGT with strong between group effects for self-rated mindfulness and rater-blinded negative symptoms as well as various within-group improvements in clinical- and process dimensions.
19-López-Navarro et al., 2022 (Spain)	26 weeks, pilot RCTs.	Included patients were recruited from a cohort study. These outpatients presented mostly a schizophrenia spectrum disorder according to the DSM-IV-TR criteria. Authors compared a mindfulness-based intervention and usual integrated rehabilitation treatment.	IRT + MBI IRT	26(80.8 %) 39.42 ± 8.63 26(76.9 %) 40.15 ± 9.38	Authors suggest that mindfulness plus standard rehabilitation treatment improves theory of mind skills related to emotion recognition, and this improvement is greater than from standard rehabilitation treatment. Add mindfulness to IRT has a larger effect on emotion recognition than on reasoning about social situations.
20-Özdemir and Kavak, 2022 (Turkey)	8-Weeks, randomized, single-blind, controlled study with follow-up period	Adults' outpatients with schizophrenia were included, according to the DSM-IV criteria. Authors compared a MBSR-like program to a psychoeducation program.	MBI Psychoeducation Control	14(65 %) 43.55 ± 11.42 7(82.9 %) 43.26 ± 12.50 10(82.1 %)	MBSR training was more effective in terms of increasing the level of hope, psychological well-being, and functional recovery of schizophrenia patients when compared with psychoeducation and control patients.

(*continued on next page*)

Table 1 (*continued*)

Study	Type and duration of trial	Key inclusion criteria//Type of protocol	Study arms	Inclusions (male %) Mean age (mean ± SD)	Key findings
				44.51 ± 10.01	
21-Shen et al., 2021 (China)	6-Weeks, randomized, single-blind, controlled study, with follow-up period for 6 months.	Included patients were adult outpatients with a diagnostic of schizophrenia based on the DSM-IV. Patients were under second generation antipsychotics, and presented residual negative symptoms, with at least one item ≥ 2 on the negative subscale of PANSS (N1–N7).	MBI Control	48(80.8 %) 59.24 ± 9.51 48(76.9 %) 59.76 ± 6.51	MBI helps schizophrenia patients with residual negative symptoms improve clinical symptoms including negative symptom, general psychopathology symptom, and cognitive impairment.
22-Tang et al., 2021 (China)	8-Weeks, randomized, single-blind, controlled study.	Adult outpatients with a diagnosis of schizophrenia according to the ICD-10 were included.	MBI Control	31(0 %) 47.16 ± 11.99 31(0 %) 48.13 ± 13.29	MBCT was effective in reducing stigma in patients with schizophrenia, which mainly manifested as changes in the patients' perception of stigma as well as the withdrawal and avoidance caused by schizophrenia. Enhancing mindfulness will help reduce the stigma level.

Abbreviations
n.a.: not available.
CPEP = Conventional psychoeducation program.
MBPP = mindfulness-based psychoeducation program.
MBCT = Mindfulness-Based Cognitive Therapy.
MBGT = Mindfulness-Based Group Therapy.
MBI = Mindfulness-Based Intervention.
MIRRORS = Mindfulness Intervention for Rehabilitation and Recovery in Schizophrenia.
PMR = Progressive Muscle Relaxation.
TAU = treatment as usual.

3.4. Cognitive techniques proposed in the MBIs programs

MBSR-like programs predominantly centered around stress reactivity and incorporated instructions like concentrated awareness of bodily sensations, thoughts, emotions, and symptoms. These programs emphasized attention training, cultivating a non-judging attitude, nurturing self-compassion, and fostering acceptance—concepts frequently associated with traditional MBSR approaches. Furthermore, participants were often provided with psychoeducational insights into stress reactivity. In select studies, this information was specifically tailored to individuals with schizophrenia spectrum disorders (SSD) through a psychoeducational course dedicated to schizophrenia (Çetin and Aylaz, 2018). These programs were primarily focused on stress-reactivity for patients with SSD, with one study explicitly targeting this area (Halverson et al., 2021) (Supplementary Table 2).

For programs resembling MBCT, the initial three sessions closely mirrored those of MBSR-like programs. Nonetheless, certain components focusing on averting depressive relapse and featuring insights on schizophrenia were substituted. This was particularly evident in the final three sessions devoted to preventing depressive relapse, where the emphasis shifted to information concerning schizophrenia. These replaced sessions concentrated on fostering self-empowerment in controlling psychotic symptoms and negative thoughts, as well as incorporating behavioral rehearsals for relapse prevention. While the number of sessions exhibited variation across studies, the initial four sessions were largely uniform in most trials. Subsequently, the subsequent four sessions were personalized for each study, notably within studies that followed MBCT-like programs. Consequently, the majority of these studies were notably inclined towards serving as psychoeducational programs (Supplementary Table 2).

In sum, for the MBSR-like program, sessions 4 to 7 mainly focus on stress reactivity, whereas in the MBCT-like program, these sessions focus on schizophrenia symptoms. In the studies reviewed, these sessions are geared towards symptoms of SSD and provide patients with cognitive-behavioral therapy (CBT) tools to manage or accept their symptoms. The retained studies follow the progressive introduction of mindfulness practice as conducted in MBSR and MBCT programs, starting with short-duration exercises on breathing, followed by yoga or mindful movement, and short meditations (generally up to 15–20 min). The authors mentioned various mechanisms involved in mindfulness, such as attention training, emotion regulation, stress regulation, self-compassion, and cognitive restructuring, including thoughts acceptance (Supplementary Table S2). Psychosocial processes, such as the importance of mindfulness training in groups and the instructor's experience and demeanour, were also emphasized by the authors (Williams et al., 2022).

4. Discussion

4.1. Main findings

Our main finding is that despite the multiplicity of existing programs that propose adaptations of the MBSR and MBCT programs for patients with SSD, there is still no clear identification of how to optimize mindfulness teaching for this population. These programs exhibit significant heterogeneity regarding session components, session length, hours of practice, meditation teaching, and instructor experience. However, the CBT component of MBCT is an add-on to the MBSR program that appears to benefit patients with SSD, at least on a psychoeducational level. Variations in program characteristics are predominantly observed in terms of program duration, the range and nature of meditation exercises, as well as the instructors' level of expertise. These differences might contribute to potential biases across the studies. Notably, the study that showcased the most comprehensive and individualized program for individuals with SSD was the Chien et al. (2017) study. This was categorized as a mindfulness-based psychoeducation group tailored for patients with SSD. Within this study, the authors modified the meditation practice duration, incorporated insights about schizophrenia, and integrated Cognitive Behavioral Therapy (CBT) techniques for managing psychotic symptoms and negative thoughts. Additionally, the program encompassed illness management strategies, problem-solving techniques, and behavioral rehearsals for preventing relapse.

Subsequently, we delve into the distinct mechanisms implicated in

Table 2
Comparison of the included programs.

Authors, year (country)	Type of program/ Number of sessions and frequency	ETHP[a]	Experience of the instructor[b]	Guided meditation[c]	Breathing exercise	Body scan or yoga exercise	Mindfulness in everyday activities	Cognitive therapy	Specific types of meditation	Homework exercise
Chadwick et al., 2009 (UK)	MBCT-like program. Weekly, 1-hour sessions.	8 h	One author, completed 3-year training in MBCT and was experienced in working with people with psychosis. The first author provided weekly supervision.	MBCT therapist	Yes. 10 min exercise and 3-minute breathing space	Yes. 10 min exercise	Yes. No details	Yes. No details	n.a.	Yes, 10-minute regular practice
Langer et al., 2012 (Spain)	MBCT-like program. Weekly. 8, 1-hour sessions.	8 h	MBCT therapist with 2 years of practice of mindfulness	MBCT therapist	Yes. No details	Yes. No details	Yes. No details	Yes. No details	n.a.	Yes
Chien and Lee, 2013 (Hong Kong)	MBCT-like program. 12 biweekly, 2-hour sessions	24 h	Psychiatrics nurses trained by the research team and a psychotherapist with a 3-day workshop and supervised practice	Psychiatric nurse or mental health professional	Yes. No details	Yes. No details	Yes. No details	Knowledge of schizophrenia and its care Empowerment of self-control of psychotic symptoms and negative thoughts Behavioral rehearsal of relapse prevention	Mindful walking	Yes
Chien and Thompson, 2014 (China)	MBCT-like program. Biweekly 12, 2-hour sessions	24 h	Psychiatrics nurses trained by the research team and a psychotherapist with a 3-day workshop and supervised practice	Psychiatric nurses	Yes. No details	Yes. No details	Yes. No details	Knowledge of schizophrenia and its care Empowerment of self-control of psychotic symptoms and negative thoughts Behavioral rehearsal of relapse prevention	Mindful walking	Yes
López-Navarro et al., 2015 (Spain)	MBSR-like program. Weekly, 26, 1-hour sessions	26 h	n.a.	Trained psychologist and psychiatrist	Yes. 15 min of breathing exercise	10-Minute exercise at beginning of each session	Yes. No details	Acceptance of thoughts, non-judging	Yes	Yes
Davis et al., 2015 (USA)	MBSR program-like. Biweekly, 75 min sessions	40 h	First author had a regular yoga and meditation practice for 3 years. The psychology trainees completed a MBSR class.	First author and doctoral-level psychology trainees	1-Minute exercise	20-Minute exercise	Mindfulness in everyday life; personal practice plan	Awareness of emotions Focus on self-compassion and acceptance	Mindful walking, Mountain meditation,	Up to 45 min of daily practice
Moritz et al., 2015 (Germany)	MBSR-like program. Weekly, 2-hour session	24 h	n.a.	Clinical psychologist	3-Minute exercise	20-Minute exercise	STOP exercise; Being mindful of needs; Bean exercise	Awareness of emotions	Morning exercise Inner smile	Yes.
Chadwick et al., 2016 (UK)	MBCT-like program. Weekly, 12, 90 min sessions	18 h	Experienced in CBT and/or mindfulness	Clinical psychologists	Yes. Up to 10 min	Yes. Up to 10 min	Yes. Up to 10 min	Voice hearing experiences and framed them using the ABC cognitive model. Weakening voice omnipotence and enhancing autonomy. Identifying and decentering from negative schemata, and building positive schematic beliefs	Mindful walking	Yes

(*continued on next page*)

Table 2 (*continued*)

Authors, year (country)	Type of program/ Number of sessions and frequency	ETHP[a]	Experience of the instructor[b]	Guided meditation[c]	Breathing exercise	Body scan or yoga exercise	Mindfulness in everyday activities	Cognitive therapy	Specific types of meditation	Homework exercise
Chien et al., 2017 (Hong Kong, mainland China and Taiwan)	MBCT-like program. Biweekly, 12, 2-hour sessions	24 h	Mindfulness training experience from 2 to 3 years	Trained psychiatric advanced practice nurses	Yes. 3-min breathing	Yes. No details	Yes. No details	Self-control of psychotic symptoms and negative thoughts Knowledge of schizophrenia Illness management and problem solving Behavioral rehearsal of relapse prevention	Mindful walking	Yes. No details
Çetin and Aylaz, 2018 (Turkey)	MBSR-like program. Twice weekly, 8, 70 min sessions	9.3 h	The researcher participated in the 8-week MBSR program and received basic training in Mindfulness Therapy.	One psychologist and 2 nurses	Yes. 3-min breathing	Yes. No details	Yes. No details	Knowledge of schizophrenia Increase insight and medication m medication adherence		Yes.
Macdougall et al., 2018 (Canada)	MBSR-like program. Weekly, 12, 1-hour session.	12 h	No details	No details	Yes. No details	Yes. No details	Yes. No details	No details	No details	No details
Shieh et al., 2018 (China)	MBCT-like program. Weekly, 8, 90 min sessions	12 h	Clinical psychologist with a regular practice of mindfulness	Clinical psychologist	Yes. 15-min breathing	Yes. No details	Yes. No details	No details	Mindfully Act, Mindful Yoga, and a Balanced Lifestyle	Yes. No details
Lee, 2019 (Taiwan)	MBSR-like program. Weekly, 8, 90 min sessions.	12 h	No details	No details	No details	Yes. No details	Yes. No details	Awareness of emotions Focus on self-compassion and acceptance	Mindful eating Self-compassion	Yes. 15 min breathing meditation
Lam et al., 2020 (Hong Kong)	MBCT-like program. Weekly, 12, 90 min sessions.	18 h	No details	Mindfulness instructor Nurse	Yes. Up to 10 min	Yes. Up to 10 min	Yes. Up to 10 min	Adapted from Chien and Lee, 2013. Engagement and empowerment; Mindfulness in daily living and problem solving; Mindfulness in illness management; and equip and prepare for the future.		
Ellett et al., 2020 (UK)	MBCT-like program. Weekly, 12, 90 min sessions.	12 h	No details	No details	No details	No details	No details	No details	No details	No details
Langer et al., 2020 (Chile)	MBCT-like program. Weekly. 12, 90 min sessions.	12 h	No details	No details	No details	No details	No details	Adapted for patients with psychosis (Chadwick et al., 2005)	No details	No details
Halverson et al., 2021 (USA)	MBSR-like program. Weekly intervention, with at least 14 sessions. Duration n.a.	n.a. (14–24 sessions)	Formed with a two-day workshop	Full time clinicians or doctoral students	No details	No details	No details	Psychoeducation on stress reactivity Positive coping strategies	No details	Yes
Böge et al., 2021a,b (Germany)	MBCT-like Program. Weekly, 4, 60	12 h	Psychotherapist trained in humanistic therapy and CBT with 10 years of	Both the psychotherapist and the psychologist	'Short' duration meditation	15 min. in third main session: "mindfulness in	Yes, emphasized. Three times a week training.	Participatory developed for patients with schizophrenia spectrum disorders (Böge et al., 2021a,b). MBGT was developed according to	Two additional 30 min session per week	Yes

(*continued on next page*)

Table 2 (*continued*)

Authors, year (country)	Type of program/ Number of sessions and frequency	ETHP[a]	Experience of the instructor[b]	Guided meditation[c]	Breathing exercise	Body scan or yoga exercise	Mindfulness in everyday activities	Cognitive therapy	Specific types of meditation	Homework exercise
	min and 2, 30 min co-sessions.		experience. One CBT psychologist in training.			the context of the body"		expert recommendations (Böge, Thomas, Jacobsen, 2022). Focus on four core components including breath, detachment, body, detachment.		
Shen et al., 2021 (China)	MBCT-like Program. Daily, 6, 45 min sessions.	22.5 h	No details	No details	No details	No details	No details	Mindfulness and rumination, cognitive patterns, understanding schizophrenia, identifying emotions during illness, self-acceptance, acceptance of medication, relapse prevention	No details	Yes
Özdemir and Kavak, 2022 (Turkey)	MBSR-like program. Weekly, 8, 90 min sessions.	16 h	No details	No details	No details	No details	No details	Coping with difficult emotions Only session 3 gives psychoinformation on schizophrenia	No details	Yes
Tang et al., 2021 (China)	MBCT-like Program. Weekly, 8, 2-hour sessions.	n.a.	Four mindfulness therapists with MBCT training certificates	Four mindfulness therapists	No details	No details	No details	The authors apply a MBCT program with some cognitive component such as acceptance of thoughts and non-judging	Mindful walking	Yes
López-Navarro et al., 2022 (Spain)	MBSR-like program. Weekly, 26, 1-hour sessions	26 h	Psychiatrist and a clinical psychologist trained in mindfulness and experienced in working with psychotic patient	The psychiatrist and the psychologist	Yes. 15-min breathing	10-Minute exercise at beginning of each session	Yes. No details	Acceptance of thoughts, non-judging	Yes	Yes

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: https://doi.org/10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/.

[a] ETHP: Estimation of the total hours of practice.

[b] Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

[c] If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

mindfulness training.

4.2. Feasibility and acceptability of MBIs for patients with SSD

Acceptability was excellent among the identified pilot and feasibility trials, with no increase in positive symptoms. Furthermore, among all identified studies, no severe side effects of the interventions were reported, particularly for some MBIs conducted for inpatients that included patients with mild to moderate positive symptoms (Böge et al., 2021a). Our findings rejoin previous findings on the safety of MBIs for patients with SSD (Böge et al., 2021b; P. Jansen et al., 2020). The limited availability of information regarding specific side effects resulting from short-term RCTs should not overshadow the possibility that long-term mindfulness practice might be linked to an increased prevalence of side effects. One hypothesis could involve patients accepting psychotic symptoms through the adoption of acceptance and self-compassion principles promoted by mindfulness practice (Dudley et al., 2017). These high rates of acceptability further support improvement of current available programs to specifically address reduction of symptoms and improvement of well-being.

4.3. Heterogeneity between studies

Initially, the early studies predominantly centered around assessing the feasibility of MBSR and MBCT programs for individuals with SSD. Subsequent studies diverged in terms of outcomes, employing a range of scales to evaluate their hypotheses. First and foremost, notable disparities were evident in the protocols adopted across the diverse intervention programs, accompanied by a scarcity of information regarding the quantity and duration of exercises provided to participants. Furthermore, the array of outcomes measured and the absence of reporting on factors such as depressive symptoms, negative symptoms, or well-being scores in several trials posed challenges in effectively comparing the programs. Moreover, the selection of the target population failed to comprehensively evaluate the impact of mindfulness on pivotal findings, particularly in cases involving patients with comorbid depression or prominent negative symptoms.

Furthermore, although most trials encouraged participants to engage in home practice, its mandatory nature was not consistently upheld. This divergence in approach was influenced by the distinction in the nature of depressive disorders and schizophrenia spectrum disorders (SSD) (Jacobsen et al., 2022). Due to these limitations, the risk of bias varied considerably between studies, limiting the meta-analyses' findings.

Considering these limitations, the extent to which mind-body practices can reduce negative or depressive symptoms remains debatable. Only the most recent included RCTs have selected chronic stable outpatients with SSD presenting prominent negative symptoms (Shen et al., 2021). The authors found that negative symptoms were significantly reduced in a sample of a hundred patients with a small effect size, which further confirms the importance of mind-body interventions to reduce negative symptoms. Nevertheless, although a total of 1500 patients participated in 22 different trials, almost every trial employed distinct programs. The initial studies primarily focused on testing the feasibility of MBSR and MBCT programs for patients with SSD. However, subsequent studies presented varying outcomes and employed different scales to test their hypotheses. More recent trials demonstrated fewer biases and revealed a pattern of similar outcomes among patients with SSD, including reductions in negative symptoms, increased well-being, and decreased hospitalization rates (Böge et al., 2020; Chai et al., 2022; Chien and Lee, 2013; Nyklíček and Kuijpers, 2008). However, it is essential to remember that these studies did not specifically target participants with prominent negative symptoms (Marder et al., 2020). Further trials should focus on a specific group of symptoms, such as prominent negative symptoms, to help clinicians to adapt their clinical interventions to subgroups of patients that are most likely to respond. The controls employed also exhibited variations across studies, encompassing waiting lists, passive controls, and active controls. In certain instances, supplementary psychoeducational or rehabilitation programs were integrated into the MBIs. However, authors often omitted to specify whether the total hours of practice or teaching were balanced between intervention groups and active control groups. This lack of clarity complicates the interpretation of meta-analyses. Lastly, significant discrepancies were observed in terms of the instructors' experience and professional background across the studies (Table 2).

4.4. Mechanism implied in mindfulness training

4.4.1. Reduction of stress, depression, and negative symptoms

Within the existing literature, compelling evidence highlights the influence of consistent mindfulness practice on neuroplasticity, resulting in alterations in both brain structure and function. Notably, these changes encompass heightened cortical thickness and shifts in neural activity within regions linked to autonomic regulation (Yang et al., 2019). Mindfulness has been shown to reduce cortisol levels, which is one of the main stress hormones produced by the hypothalamic-pituitary-adrenal axis, leading to the reduction of chronic stress response (Tang et al., 2015). Mindfulness training reduces sympathetic activity, which decrease heart rate and blood pressure, and increase parasympathetic activity, leading to increased heart rate variability and better stress resilience. Other mechanisms are also found, such as the reduction of inflammatory cytokines (Carlson et al., 2007; Roohi et al., 2021), increase serotonin and delayed melatonin secretion (Mohan et al., 2023) and increase in GABA production (Tang et al., 2020).

Herein, we could argue how on the neurobiological level, depressive and negative symptoms could be reduced by mindfulness training. First cortisol secretion reduces the negative effects of chronic stress. Second, with the increase oxytocin levels, that could promote social connection, feelings of compassion and empathy (Sabe et al., 2021). And finally, the increase of dopamine levels in certain brain regions, suggesting that it may enhance motivation and positive affect (Kirschner et al., 2021). Moreover, these elements could also increase well-being, which was an outcome in different studies, by the beneficial effects of mindfulness on physical and mental health.

Patients with negative symptoms present low-self-esteem, asociality, amotivation, and difficulty embracing resonance and connectivity with oneself, the environment, and others. Moreover, with alogia and diminished expression, these patients all share the difficulty to reconnect with oneself and others within the context of a group-based intervention. Mindfulness practice is sought to enhance metacognition, which can notably modulate anticipatory pleasure, an essential target to alleviate amotivation (Abram et al., 2022). Moreover, considering the role of social and self-stigma, Mindfulness in a group setting allows non-judgement expression of internal experiences and gives room to embrace these emotions. Evidence from the neurophenomenological approach, proposes that mindfulness-training promote experience of self-awareness and body-awareness, which could ultimately improve social connectedness (Dor-Ziderman et al., 2013; Töbelmann et al., 2023).

4.4.2. Psychosocial processes implied in mindfulness groups

Mindfulness training in group settings is essential to its efficacy on patients' symptoms (Cormack et al., 2017). The typical 8 sessions of mindfulness-based intervention are regarded as a shared journey for all participants, using a specific culture and sense of safety. This setting helps patients to share communal experiences that augment learning and enrich mindfulness practice, which is vital for patients with SSD that typically report low global self-esteem (Gureje et al., 2004). The group-based aspect of MBIs could be potentially considered more effective in negative symptom reduction than individual acceptance and commitment therapy. Results from available meta-analyses could indicate that the effects of MBIs such as MBCT and MSBR for psychosis have better effect sizes on reduction hospitalization length, negative symptoms and

depression scores than ACT, control groups with TAU, and other active control groups (Jansen et al., 2019). According to a recent meta-analysis (Jansen et al., 2020a) it seems that traditional group-based MBIs such as MBCT and MBSR for psychosis might be more effective in ameliorating negative symptoms compared to trials conducting individual acceptance and commitment therapy which rather showed effects on promoting acceptance and compassion as means of change (Louise et al., 2018; Böge et al., 2021a). Nevertheless, without more trials comparing group-based interventions to ACT therapy, it is difficult to conclude to the superiority of groups-based interventions.

This training can help patients with SSD to listen to other patients and express their thoughts and emotions. As such, mindfulness training in groups also helps to enhance empathy (Wu et al., 2022). A recent study also proposed that increased metacognitive awareness of others and mindfulness predicted greater self-compassion, whereas increased cognitive insight predicted a more significant lack of self-compassion (Hochheiser et al., 2019). To note, the mindfulness instructor also holds an essential role, in both the embodiment of the mindfulness practice, and the teaching of an empowering way of dealing with problems (Van Aalderen et al., 2014). The prior experience of the mindfulness instructor in mindfulness is also crucial for the effectiveness of interventions (Van Aalderen et al., 2014).

Another important aspect affecting patients with SSD is the internalization of the social- and structural-stigma. Stigma has also been proposed as a potential risk factor for developing the disease during the prodromal phase leading to social isolation (van Zelst, 2009). Some authors propose that mindfulness training can help patients to be more aware of internalized stigmatic thoughts, which could help patients to cope with their negative consequences (Tang et al., 2021; Yılmaz and Kavak, 2018). Moreover, some authors propose that mindfulness could improve patients' psychosocial functioning, quality of life, and self-esteem (P. Jansen et al., 2020).

4.4.3. Cognitive and emotional process implied in mindfulness groups

Mindfulness training is acknowledged for its ability to enhance attention and the regulation of emotions, consequently fostering effective stress management. This potential is particularly relevant for patients with SSD who often exhibit heightened exposure to stressors and increased sensitivity to stress. (Grattan and Linscott, 2019). Some studies also found that mindfulness training was associated with better cognitive and psychological flexibility (Böge et al., 2021a), with decreases in rumination and symptoms of depression (Deyo et al., 2009). However, patients with SSD present specific alteration of executive function, such as attention, planning, inhibitory control and mental flexibility (Tyburski et al., 2021). In particular, they also present the wide use of thought suppression (Popa et al., 2020), with an association between thought suppression and automatic thoughts, the latter being strongly associated with depression (Popa et al., 2020). Considering that the training of attention permit to improve psychological flexibility, mindfulness training help to reduce though suppression attempts (Tang et al., 2007), with the culture of acceptance consisting in being mindful of unwanted thoughts - by not letting them being suppressed and subsequently heightened (Chadwick et al., 2009). Such cognitive flexibility might be difficult for some patients with SSD, which also presents a lack of insight that is correlated to number of hospitalizations, positive and negative symptoms and treatment adherence (Joseph et al., 2015). Böge and colleagues proposed that mindfulness helps in the understanding of the transient nature of psychotic symptoms, which can help to alleviate them (Böge et al., 2020). However, insight might only accounts for a minor part of psychotic symptoms variability (Joseph et al., 2015). This could be explained by the fact that mindfulness aims not to directly decrease symptoms but to promote acceptance of symptoms.

4.5. Recommendations to design more similar and structured MBIs programs for patients with SSD

The authors who have formulated MBSR-like and MBCT-like programs frequently draw upon the feasibility trials conducted by Chadwick and colleagues in 2009 as a foundational reference for designing their own studies. In the Chadwick et al. trial, a series of key benchmarks were introduced to tailor mindfulness training for individuals with psychosis. Nevertheless, it's important to note that Chadwick and colleagues' initial efforts primarily concentrated on addressing positive symptoms. Subsequent work has extended its focus to encompass other symptoms exhibited by individuals with SSD, as exemplified in the research conducted by Shonin and colleagues (Shonin et al., 2013) and Böge and colleagues (Böge et al., 2021b). By examining the programs of all identified interventions and considering the available recommendations, we can summarize the following principles:

(1) explore current coping strategies and introduce mindfulness as an additional strategy; (2) gradually introduce longer guided meditations to avoid prolonged periods of silence (no >20 min); (3) the proposed sessions are less intensive (up to 1 h) compared to standard MBSR/MBCT programs; (4) focus on the practice of mindfulness rather than exploring past history or trauma; (5) emphasize acceptance and a non-judging posture as an alternative to suppressing distressing thoughts or emotions; (6) use easily understandable language and avoid hypnotic suggestions; (7) homework practice is optional. Furthermore, our qualitative synthesis revealed additional details, such as the inclusion of audios recordings and manuals for participants in the majority of the programs. Interestingly, none of the conducted trials included the additional retreat day typically offered in MBSR and MBCT programs. Cohort follow-up study of long-term mindfulness practitioners should also be conducted to explore potential benefits or side effects associated with such a practice.

5. Conclusions

Mindfulness-based approaches are effective and safe interventions for patients with SSD. The identified trials present important heterogeneity regarding session component, session length, hours of practice, of meditation teaching and experience of instructors. Nevertheless, important progress has been made and most recent trials start to replicate similar structured programs. For future work, a consensus approach to design a more reproductible MBCT-like program adapted for patients with SSD should be conducted.

CRediT authorship contribution statement

MS and KB designed the study and wrote the protocol. RK and NP conducted literature searches and provided summaries of previous research studies. RK the first draft of the manuscript and all authors contributed to and have approved the final manuscript. All authors contributed equally to this work.

Declaration of competing interest

All authors report no conflicts of interest.

Data availability

The data used in the analyses of this manuscript is available upon reasonable request.

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Appendix A. Supplementary data

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