Review

Therapeutic potentials of mind–body interventions for psychosis

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Practice points

- Antipsychotics are efficacious against hallucinations and delusions, but have limited effects on negative symptoms and cognitive deficits.
- Mind–body exercise is proved to be beneficial in improving symptoms, cognitive function and psychosocial functioning. No adverse events waere reported by previous studies.
- Mindfulness-based therapies were moderately effective in reducing negative and affective symptoms.
- It is feasible and acceptable to develop mind–body interventions as a complementary treatment in clinical practice for psychosis.

Mind–body intervention has attracted growing interest for treating patients with psychotic disorders as a complementary strategy. Numerous clinical trials have confirmed its positive impacts on psychotic symptoms, cognitive function, psychosocial functioning and affective dysfunction. It is feasible and acceptable to develop such interventions in clinical practice for psychotic patients.

Keywords: mindfulness • mind–body intervention • psychosis • tai chi • yoga

Psychosis is a syndrome characterized by a diverse set of perception disturbances and impairments in cognitive and psychosocial functioning, as well as affective expression and communication with others. These abnormalities are generally classified into positive, negative, disorganization, cognitive, mood and motor symptom dimensions, with psychopathological differences across individuals and stages of the illness [1]. Hallucinations and delusions are the core positive symptoms of psychosis. Patients perceive these symptoms as real whereas others regard them as implausible. The experience of positive symptoms is associated with increased levels of emotional disturbances, such as depression, anxiety and hopelessness. These emotional disturbances fluctuate during the course of the illness and may adversely affect patients' coping ability and psychosocial functioning [2]. After years of therapeutic development, it is agreed that the ideal contemporary treatment for psychosis requires a combination of pharmacology, psychosocial therapy and community support.

The past & the present

Pharmacological treatment for psychosis

During the last two decades, medications that act by relieving psychotic symptoms, such as hallucinations and delusions, were the mainstay of treatment for psychosis in clinical practice [3]. Antipsychotics, both first and second generation, were found to be efficacious in relieving psychotic symptoms and improving mental condition [3–5]. Some meta-analytic reviews suggested the superiority of some second-generation psychotics over the first-generation psychotics in reducing extrapyramidal symptoms, tardive dyskinesia [6] and in relapse prevention [7].

Future Medicine part of fsg

Although antipsychotics are found to be efficacious against positive and disorganization symptoms in psychosis [8], the remission rate varies along the course of the illness. A recent review paper indicated that the rate of remission ranged from 17 to 78% in first-episode schizophrenia, and from 16 to 62% in multiple-episode schizophrenia [9]. Treatment resistance is another clinical challenge in the pharmacological management of psychosis. It is estimated that approximately 20–30% of all patients with schizophrenia do not respond adequately to an initial antipsychotic trial [10]. Moreover, there is limited evidence to demonstrate the efficacy of medications in eliminating negative symptoms and cognitive impairments, which can have adverse impact on the daily functioning of psychotic patients [11,12]. Adverse effects after taking antipsychotic drugs are also a widely shared concern of patients and are associated with poor drug compliance. Generally, second-generation psychotics have a lower likelihood of causing acute extrapyramidal symptoms and tardive dyskinesia compared with first-generation psychotics, but a higher likelihood of causing metabolic side-effects and weight gain [6]. Other adverse effects, including prolonged QT interval [13], sedation and sexual dysfunction, were reported across different classes of neuroleptics [14].

Psychosocial therapies for psychosis

As antipsychotic drugs have limitations in tackling the cognitive impairments and negative symptoms of psychosis, a variety of psychosocial and behavioral therapies have been recommended in conjunction with medications to improve prognosis and long-term outcomes. Since the 1980s, clinical research has increasingly suggested that community-based psychosocial treatments could not only address symptoms, relapse and treatment adherence of patients with psychosis, but also improve their functioning and quality of life [15–17].

Cognitive behavioral therapy (CBT), originally developed by Ellis [18] and Beck [19], draws on the principles of cognitive therapies to release the distress induced by the symptoms of psychosis [20]. CBT usually explores the subjective nature of psychotic symptoms, challenges the evidence and the subject's habitual patterns of thinking about the belief, restructures the beliefs and experiences according to the present situation, and strengthen adaptive coping ability, aiming to reduce patients' distress from hallucinations and delusions. [21]. Over the past two decades, the application of CBT in psychotic disorders has garnered a growing interest. In a recent empirical review, a number of randomized controlled trials (RCTs) found that CBT was able to show a significant reduction in hallucinations and delusions in patients with schizophrenia or psychosis [22], and the advantages could be maintained for as long as 12 months [23]. However, CBT was reported to have less benefit on the negative symptoms [24] and persistent severe psychotic symptoms [25,26].

Assertive community treatment (ACT), originally developed in the 1970s, is a multifaceted approach with case management that targets difficult-to-engage or refractory schizophrenia [27]. Case management provides patients with a multitude of services to meet the demands of returning to the community and society. Patients are assigned to a multidisciplinary team consisting general physicians, psychiatrists, nurses and case managers with a high staff-to-patient ratio. The team provides all types of services, including home delivery of medication, monitoring of physical and psychological health, social skills training and regular contact with family members, thus providing support whenever and wherever the patients need it. The ACT model has demonstrated consistent benefits and has significantly reduced the time spent in the hospital, improved patients' housing stability and increased satisfaction in both patients and their families [28–30].

Family therapy is another psychosocial intervention found to be associated with fewer relapses and rehospitalizations in patients with schizophrenia. It equips family members with the skills and knowledge to cope with the disease through psychoeducational and behavioral techniques, which reduces the risk of relapse and rehospitalization [27]. A large number of studies have demonstrated reduced relapse rates, with approximately 24% of patients receiving family therapy relapsing versus 64% in those receiving only standard care [31]. The advantages shown by long-term family therapy could be maintained for up to 2 years or even longer [32]. Recent reviews of different modes of family-based therapy reveal that it can significantly improve patients' medication compliance, family members' knowledge about the illness and reduce relapse and family burden [16,33].

Other effective psychosocial interventions, including cognitive remediation therapy and social skills training, are also important in treating other specific dysfunctions of psychotic patients. Cognitive remediation therapy targets impaired attention, working memory, executive function and psychomotor function, which are found widely among patients with psychotic disorders [34]. These impairments may persist throughout the course of the illness, and result in poor social and occupational functioning [35]. Most RCTs of cognitive remediation in patients with schizophrenia have shown medium-sized effects in improving attention, processing speed, working memory and executive functioning [36]. Despite the improvements of cogni-

tive performance in schizophrenia by remediation therapy, the inconsistent and questionable generalizability, as well as the long-term effects of the therapy are still matters of concern.

Social skills represent the combination of behaviors in appropriate sequences and usage within social contexts. It reflects social competence and enables a person to achieve successes in daily life [37]. A lack of social skills is one of the major deficits in patients with schizophrenia [37]. The key components of social skills include receiving, processing and sending information [38]. Most clinical studies of social skills training during the 1980s and 1990s suggested considerable effects on improving living skills and social adjustment in patients, but failed to demonstrate its benefits in reducing positive symptoms and improving complex social skills such as job-related skills [39]. A recent meta-analysis review of 22 RCTs reported that this training domain improved social functioning and negative symptoms with a moderate effect size for schizophrenia, and reduced rehospitalization rates at 1–2 years follow-up [40]. However, the effects on psychopathology, positive symptoms, relapse and cognitive function have not been reported [41,42]. Usually, social skills training are applied in combination with other psychosocial interventions, to generalize the skills to real life. Hogarty and Flesher found that patients with schizophrenia receiving cognitive remediation combined with social skills training significantly enhanced their participation in vocational activities and achieved better mastery of living and working ability [43]. An integrated model of social skills training together with other psychosocial therapies has been recommended to produce synergic effects on the social and community skills and functioning of people with schizophrenia [44].

The present & the future

Recently, mind–body interventions have attracted a lot of attention for treating psychiatric disorders. Mind–body interventions focus on the communication and connectivity between the mind and the body, in which the mind's capacity and the body's physiology affect each other dynamically [45]. Mind–body therapies target emotional, mental and spiritual factors that directly affect physical health. The main mind–body interventions include meditation, yoga, tai chi and mindfulness-based programs. The basic dynamic feature of these interventions is the relaxation response, a state in which the metabolism slows down and oxygen uptake is facilitated [46]. The characteristics and advantages of these mind–body interventions are summarized in Table 1.

Mind–body exercise

Mind–body exercise is a form of physical exercise integrating body movement with mental focus. The Idea Health and Fitness Association (in the 1990s) defined it as "physical exercise executed with a profoundly inwardly directed focus" [47]. Mind–body exercise mainly employs ancient eastern disciplines, such as yoga and tai chi, characterized by inner mental focus, concentration on the movements of the body, con-

Table 1. Summary of the characteristics and advantages of mind–body intervention.

Mind–body intervention	Characteristics	Advantages
Yoga	An ancient Hindu practice, combining breathing, physical postures and meditation. It is intended to encourage coordination between the body and the mind, to inspire relaxation and awareness. Yoga emphasizes slow and deep breathing, structural alignment and gentle stretching of the physical body through the asanas and props (belts, blocks)	Benefits the individual's physical and psychological health, by enhancing one's consciousness of the body and its capabilities, increasing energy levels, mental clarity and concentration. Creates inner, physical and emotional balance through the use of body postures with breathing control. Researchers have demonstrated its effectiveness for symptoms and emotions in some psychiatric disorders
Tai chi	A traditional Chinese form of exercise characterized by circular movements with strength and softness. These movements are continuous and emphasize the exercise of mind and consciousness	Strengthens the muscles and joints, increases balance and stability. Benefits cardiorespiratory function, mental control and immunological capacity
Mindfulness-based intervention	A mind training to accept relevant aspects of experience in a non-judgmental manner. Focuses on modifying the individual's relationship to their thoughts more broadly	Allows one to maintain awareness of the present, releasing control and attachment of beliefs, thoughts and emotions, resulting in a great sense of emotional well-being and balance by letting go of one's thoughts and mind

trolled breathing, attention to alignment and a belief in energy flow.

Yoga and tai chi are typical mind–body exercises integrating body, mind and spirit. Both exercises originate from ancient eastern healing practices, and are renowned worldwide nowadays for their significant physical and mental benefits. Both encompass breathing and physical postures, with an additional component of meditation/relaxation in yoga. These mind–body exercises have been suggested to create physical, emotional and spiritual balance, while enhancing self-fulfillment and self-realization [48].

Unlike aerobic exercise, which puts demands on the cardiovascular systems by increasing the heart rate and breathing rate, yoga is characterized by inner mental focus, concentration on the movements of the body and controlled deep breathing aiming to create inner, physical and emotional balance. Hatha yoga is the most comprehensive and widely researched type of yoga in clinical trials. It has been proven that yoga can reduce stress and anxiety [49] and improve memory and sustained attention in healthy people [50]. Based on this evidence, yoga therapy has been increasingly used to ameliorate symptoms and emotional deficits in schizophrenia [51–53]. Two review papers of three RCTs with high methodological quality examined the effects of yoga on schizophrenia spectrum disorders, and observed significant reductions in the positive and negative syndrome scale (PANSS) total score, positive syndrome, negative syndrome and general psychopathology subscores in patients treated with yoga, compared with wait-list controls or the stretching exercise group [54,55]. A recent RCT compared the therapeutic efficacy of yoga with exercise and wait-list controls in stabilized outpatients with schizophrenia. Similar improvements in clinical symptoms and social functioning scores were reported in the yoga therapy group [52]. Two other RCTs of yoga intervention in hospitalized schizophrenic patients found reduced psychotic symptoms and depression, in addition to improved performance in basic living skills and subjective well-being compared with the exercise group [53] or the standard care group [56]. However, a recent meta-analysis review of five RCTs including 337 patients with schizophrenia revealed no evidence for short-term effects of yoga on positive symptoms and negative symptoms, but moderate effects on quality of life compared with usual care [57].

Besides the beneficial effects on symptoms, patients who practiced yoga for 4 weeks demonstrated significant improvement in facial emotion recognition impairments and socio-occupational functioning, as well as an increase in plasma oxytocin levels compared with wait-list controls [58]. Ikai *et al.* observed the benefits of yoga therapy on postural stability in a group of patients with schizophrenia-spectrum disorders after receiving an 8-week yoga therapy program [59].

No adverse events due to practicing yoga were reported in any of these studies, although the measures of adverse events varied across the studies. Yoga as an adjunctive therapy in schizophrenia has been suggested to be feasible and effective [60]. All the published studies mentioned above used an integrated style of yoga that included breathing, asanas and relaxation without meditation. The intervention period varied from 4 to 16 weeks, and the duration of training with an instructor varied from 3 to 8 weeks. One study reported that even a single 30-mininute yoga session in patients with schizophrenia or related disorders resulted in significantly decreased anxiety and psychological stress, and increased subjective well-being with a large effect sizes compared with controls [61].

The mechanisms that mediate the therapeutic benefits of yoga on psychotic disorders and cognitive functions have yet to be clarified. However, several hypotheses of potential mechanisms have been proposed. First, the voluntary control of breathing as practiced in yoga causes alterations in the autonomic system, resulting in improved and balanced autonomic function. The controlled breathing during yoga practice may strengthen parasympathetic nervous activity and attenuate sympathetic nervous activity by modifying cardiac ventricular functioning [62,63]. A functional near-infrared spectroscopy study showed that regional cerebral blood flow in bilateral pre-frontal areas significantly increased during high frequency yoga breathing [64]. Second, an increasing amount of evidence suggests that certain yoga techniques may improve physical and psychological health through down-regulation of the hypothalamic–pituitary–adrenal axis, which is one of the primary systems responding to stress and anxiety [65]. Third, it has been speculated that yoga may alleviate some psychological symptoms by altering several biological markers and restoring physiological balance, such as lower salivary cortisol levels [66] and higher blood serotonin levels [67].

Compared with yoga, less research has investigated the potential benefits of tai chi for patients with schizophrenia. Based upon eastern health philosophy similar to yoga, tai chi emphasizes the connectivity between the body and the mind, motor coordination and mental alertness [68]. Previous study in chronic patients with schizophrenia found that tai chi reduced negative symptoms after receiving an 8-week program [69]. A recent RCT in residential patients with schizophrenia reported that a 12-session tai chi program buffered from deteriorations in movement coordination and interpersonal functioning compared with the wait-

list group, but failed to find any significant improvement in negative symptoms [69]. These preliminary findings suggest that tai shi has a protective effect for patients with schizophrenia as a supplementary treatment for regular pharmacological and rehabilitation care, and further research is warranted. An overview of clinical studies of mind–body exercise for psychosis is summarized in Table 2.

Mindfulness-based Interventions

In recent years there have been newer therapies incorporating acceptance-based approaches into the cognitive-behavioral framework to alleviate depression and anxiety associated with psychological disorders [86]. Acceptance and commitment therapy (ACT) [87] is one such therapy based on Relational frame theory, a behavioral theory concerned with the nature of language and cognition [88]. Compared with traditional CBT, ACT seeks to modify the individual's relationship with their thoughts rather than to directly alter thought contents through rational deliberation.

The first non-blind RCT investigating the efficacy of ACT in patients with psychosis by Bach and Hayes [89] demonstrated a significantly lowered rehospitalization rate in the ACT group compared with the treatment as usual (TAU) group. Gaudiano and Herbert [72] replicated the study of Bach (2002) by randomly assigned 40 in-patients with psychotic disorders to either the TAUl group (ETAU) or the ETAU plus ACT group. Patients in the ACT group received an average of three individual sessions during their hospitalization. Symptoms and functioning measures were administrated pretreatment and prior to discharge. The rehospitalization data were obtained at 4-month follow-up. The results suggested short-term benefits in affective symptoms, social impairment and distress associated with hallucinations for the ACT group at discharge, more patients in the ACT group reached significant improvements in clinical symptoms. The rehospitalization rates were lower in the ACT group at 4-month follow-up although not reaching statistical significance [72].

A recent blind RCT of ACT examined its effects on emotional dysfunction (depression and anxiety) following an acute episode of psychosis [76]. A total of 27 patients recruited from an early intervention service for psychosis were randomized to either ten sessions of ACT plus TAU or TAU alone. Patients in the ACT group were taught to distinguish internal and external experiences, to identify and move towards valued goals, and to observe and accept mental experiences without judging them as true or false. A mindful breathing exercise was also included in the treatment. General clinical symptoms and therapy-specific outcomes were measured at baseline and 3 months post-treatment. A significantly greater proportion of the ACT group demonstrated reduced depression compared with the TAU group. The ACT group showed a significant improvement in acceptance and mindfulness skills, as well as a significant reduction in negative symptoms. Furthermore, correlation analysis indicated that changes in acceptance skills were positively correlated with changes in depression. Another RCT of ACT for psychotic patients demonstrated long-term effects on rehospitalization rates at 1 year post-discharge [80]. These studies provide promising evidence that ACT may be an acceptable intervention for ameliorating negative symptoms and depression, reducing rehospitalization rates and crisis contacts in patients with psychosis.

Mindfulness is a form of insight meditation originated from the Buddhist tradition, which is involved in ACT as an important component. According to Kabat-Zinn [90], mindfulness means "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally." People undergoing mindfulness training are asked to be aware of their experiences and emotions at the present-moment, with an attitude of openness and acceptance, allowing the thoughts and emotions to be as they are and let them go without any judgment.

Mindfulness-based interventions are referred as the third wave of behavior therapies after the first, traditional behavior therapy, and the second, cognitive therapy [91]. There have been several studies of mindfulness-based programs as mind–body interventions for patients with psychosis [73,75,77,82–85,92,93]. A case study of two patients with chronic schizophrenia with current auditory hallucinations found that after 2–3 weeks of mindfulness practice, the conviction and distress induced by auditory hallucinations were reduced for both cases, and their mindfulness scores improved post-treatment [75]. Guided mindfulness practice in this study involved grounding in the body, mindful breathing and mindfulness of all sensations, thoughts, feelings, images and voices entering awareness [75]. Another RCT of mindfulness training in 25 psychosis patients with current distressing psychotic experiences reported that there were no significant differences between the intervention and the wait-list control group in clinical outcomes and therapy-related measures. However, when combing both groups and comparing scores pre- and post-treatment, there was a significant improvement in clinical functioning and mindfulness of distressing thoughts and images [73].

Three clinical trials successfully applied mindfulness-based therapy in patients with early psychosis and found positive effects on symptom severity and

Table 2. Overview of mind–body interventions for psychosis.

Study (year)	Mind-body intervention type	Comparison group	Relevant results and conclusion	Ref.
Mind–body exercise (yoga)				
Duraiswamy *et al.* (2007)	Swami Vivekananda yoga	Physical exercise	Yoga reduced symptoms and improved quality of life compared with physical exercise. No serious adverse events or physical complications	[51]
Behere *et al.* (2010)	Swami Vivekananda yoga	Exercise and wait-list control	Improved performance on cognitive task in yoga group	[58]
Visceglia & Lewis (2011)	Yoga	Wait-list control	Decline of symptom scores and increases of quality of life scores in yoga group.	[70]
Vancampfort *et al.* (2011)	Yoga	Aerobic exercise and reading control	Reduced state anxiety and stress, increased subjective well-being in yoga group	[61]
Varambally *et al.* (2012)	Yoga	Exercise and wait-list control	Improvement was found in yoga group for negative symptoms and social functioning	[48]
Paikkatt *et al.* (2012)	Yoga	Standard care	Yoga improved general well-being, basic living skills and overall functioning	[56]
Manjunath *et al.* (2013)	Yoga	Exercise	Yoga group had lower scores on clinical symptoms	[53]
Jayaram *et al.* (2013)	Swami Vivekananda yoga	Wait-list control	Yoga group showed a significant improvement in social-occupational functioning, increased level in oxytocin	[58]
Ikai *et al.* (2013)	Yoga	Regular day-care	Yoga could improve postural stability	[59]
Bhargav *et al.* (2014)	Yoga breathing	No comparison	Yoga increased blood flow in prefrontal area in normal controls, but not in patients with schizophrenia	[64]
Mind–body exercise (tai chi)				
Ho *et al.* (2012)	Wu-style Cheng-form tai chi	Standard residential care	Tai chi group had improved motor coordination and social functioning	[71]
Mindfulness-based intervention				
Gaudiano & Herbert (2006)	ACT	TAU	The ACT group showed greater improvement in distress related to psychotic symptoms	[72]
Chadwick *et al.* (2009)	Mindfulness	Wait-list control	Mindfulness training revealed significant improvement in clinical functioning and distressing thoughts	[73]
Laithwaite *et al.* (2009)	Compassionate mind training	No control	Significant changes were found in depression and general psychopathology in patients with schizophrenia	[74]
Newman Taylor *et al.* (2009)	ACT	Case study without control group	Mindfulness had an impact on affective symptoms related to voices	[75]
White *et al.* (2011)	ACT	TAU	ACT group showed reduced depression and negative symptoms	[76]
Langer *et al.* (2011)	Mindfulness	Wait-list control	Mindfulness group exhibited positive changes in symptoms and mindfulness skills	[77]
Dannahy *et al.* (2011)	Group person-based cognitive therapy	No control	Group person-based cognitive therapy for distressing voices may prove a useful addition to existing psychological interventions and is worthy of further investigation	[78]
Johnson *et al.* (2011)	Loving–kindness meditation	Uncontrolled design	The intervention was feasible and associated with decreased negative symptoms and increased positive emotions and psychological recovery	[79]

ACT: Acceptance and commitment therapy; MBPP: Mindfulness-based psychoeducation program; TAU: Treatment as usual.

Table 2. Overview of mind–body interventions for psychosis (cont.).

Study (year)	Mind-body intervention type	Comparison group	Relevant results and conclusion	Ref.
Bach *et al.* (2012)	ACT	TAU	ACT groups showed reduced hospitalization compared with those in TAU	[80]
Shawyer *et al.* (2012)	Treatment of resistant command hallucinations	Befrieding and Wait-list control	No significant differences were found between treatment of resistant command hallucinations and befriending on the compliance and coping with command hallucinations. Both therapies were beneficial for clinical symptoms and distress related to symptoms	[81]
Van Der Valk *et al.* (2013)	Mindfulness	No control	A decrease was found in psychological symptoms in mindfulness group	[82]
Chien *et al.* (2013)	MBPP	Usual care	The MBPP was found to be more effective than usual psychiatric care in functioning and insight of illness	[83]
Khoury *et al.* (2013)	Compassion, acceptance and mindfulness	No control	Overall results support the acceptability, feasibility and potential clinical utility of mindfulness. A significant increase in emotional self-regulation and a decrease in affective symptoms were found	[84]
Chien & Thompson (2014)	MBPP	Usual care	MBPP appears to be a promising approach for Chinese patients with schizophrenia in symptoms and quality of life	[85]

ACT: Acceptance and commitment therapy; MBPP: Mindfulness-based psychoeducation program; TAU: Treatment as usual.

emotional functioning [82–84]. Two non-randomized, non-controlled prospective studies were conducted in a small sample of patients with first-episode psychosis. The results of these two pilot studies suggested that an 8-week mindfulness-based therapy may help reduce agoraphobic symptoms, psychoneuroticism [84] and psychological symptoms including depression, anxiety, somatic concerns, in addition to improving emotional self-regulation and self-care [82]. Chien and Lee conducted a multisite RCT of a mindfulness-based psychoeducation program in 96 Chinese patients with schizophrenia at their early stages targeting psychotic symptoms and psychosocial functioning [83]. Compared with those receiving usual care, the patients in the mindfulness-based psychoeducation program showed significant improvements in symptom severity, social functioning and illness insight at 24 weeks post treatment, and a significantly lowered rehospitalization rate at the 18-month follow up [83]. A recent long-term follow-up study in Chinese patients with schizophrenia indicated that the mindfulness-based psychoeducation program improved overall symptoms, psychosocial functioning, insight and duration of readmissions to hospital compared with the conventional psychoeducation program and usual care over a 24-month period [85].

Overall, the results from these studies supported the acceptability, feasibility and potential clinical application of the new treatment. A meta-analysis of 13 studies in psychosis showed that mindfulness-based therapies were moderately effective in reducing negative and affective symptoms and enhancing functioning and quality of life [94]. The effect sizes of these effects were comparable to those observed from CBT in psychosis [95].

Mindfulness was delivered as a part of many forms of interventions, including the ACT [89], mindfulness-based psychoeducation program [83], person-based cognitive therapy [78], loving-kindness meditation [79] and compassion focused program [74]. Existing clinical trials of mindfulness-based therapies have been listed in Table 2. Despite the heterogeneity of these therapies, all the mindfulness-based interventions shared basic components: self-regulation of attention through breathing practice or body scanning skills; an orientation toward the present moment with an attitude of openness, compassion and acceptance; and aiming to change the relationship with psychotic symptoms and emotional dysfunction rather than to change them directly. Two qualitative studies using grounded theory analysis addressed the main process of mindfulness related to psychosis and daily life [92,96]: the regular utilization of mindfulness; awareness of psychotic experiences by focusing on one's breath and body; changing relationships between symptoms as well as other people with an attitude of letting go; and acceptance of psychosis and the self by reclaiming power.

Meditation-induced psychosis has been reported by several case studies over the decades [97–100]. Kuijpers *et al.* concluded that about half of the subjects had

a psychiatric history and almost all psychotic experiences induced by meditation were transient and involved mixed psychotic and affective symptoms [97]. As meditation may induce related psychotic symptoms in subjects with a psychiatric history, the clinical application of mindfulness-based therapies should be cautious.

The effects of mind–body interventions differed in different stages of the illness. Most studies of yoga and tai chi were conducted in stabilized patients with psychosis, and found that both mind–body exercises were effective mainly on negative and depressive symptoms. There is emerging evidence that mindfulness-based intervention is beneficial for patients with active psychotic disorder. Two case studies of schizophrenic patients with current auditory hallucinations demonstrated that belief conviction and distress were reduced, and mindfulness scores increased for both participants after 12-week mindfulness treatment [75]. Another study investigated the feasibility of applying mindfulness in an inpatient clinic for individuals with psychotic symptoms and treatment resistant psychosis, and found that a 6-week mindfulness exercise was acceptable and well-tolerated by participants [101]. Compared with yoga and tai chi, mindfulness has more advantages in helping patients with distressing psychosis, by providing them with an alternative way to be less overwhelmed by their psychotic experiences, and more confident in their ability to live with them. Large data-sets are required to demonstrate any clinically significant changes associated with mindfulness intervention in severely psychotic patients compared with healthy subjects.

Numerous neuroscientific researchers have begun to investigate the effects of mindfulness and meditation on brain structures and functions. Scientists began with electroencephalographic studies to examine changes of brain activity during meditation in the late 1960s. Long-term meditation practitioners demonstrated higher levels of alpha and theta band activity at baseline, which is similar to sleeping and resting [102–104]. With the development of neuroimaging techniques over the last 15 years, structural and functional MRI has been used to address brain responses to meditation. A recent review and meta-analysis of 21 morphometric imaging studies found meditation-related increases of grey matter in nine regions, including the prefrontal cortex, anterior/mid-cingulate cortex, insular cortex, somatomotor cortices, inferior temporal gyrus, fusiform gyrus, hippocampus, corpus callosum and the superior longitudinal fasciculus [105]. Consistent findings of functional MRI studies indicated increased activity in the prefrontal cortex, anterior cingulate cortex and the insula during meditation [106]. A controlled longitudinal study showed increased gray matter in the hippocampus and the posterior cingulate cortex after receiving an 8-week mindfulness-based stress reduction program [107]. A recent RCT in subjects with mild cognitive impairment indicated that the default mode network may also be impacted by meditation [108]. In this study, the mindfulness-based stress reduction program group demonstrated increased functional connectivity between the posterior cingulate cortex, the bilateral medial prefrontal cortex and the left hippocampus compared with those who underwent usual care.

Conclusion

Although promising improvements through mind–body interventions were observed in clinical symptoms, cognitive and psychosocial functioning, and affective dysfunction of patients with psychosis, the application of these therapies in treating the illness is still in its early stages, and the underlying neurological and biological mechanismsremain unknown. The proper application of these mind–body interventions needs to be further studied.

Implications & future perspective

The key findings of the reviewed studies provide early-stage evidence in terms of the value of mind–body interventions for people with psychotic disorders. Mind–body exercise appeared to be effective in reducing clinical symptoms and improving quality of life for patients with psychosis, and mindfulness-based therapies showed significant benefits in changing the relationship between patients and psychotic symptoms, resulting in reduced depression and anxiety, in addition to improved social functioning and insight of the illness. These promising findings confirmed the feasibility and acceptance of mind–body interventions as alternative treatments in the clinical setting.

Several obstacles and difficulties of mind–body interventions should be noticed in clinical practice. Motivating these patients to keep attending the group-based interventions is an important step. Choosing the right form of mindfulness practice, and the suitable intensity and duration are critical steps to avoid meditation-related psychosis. Ensuring consistent and regular practice on a daily basis is also a challenge for clinical application. Regularity and repetition are the most important strategies to achieving effectiveness of mind–body interventions. Providing individual support and encouragement is also necessary.

Future research is needed to explore the pattern of acquisition of mind–body intervention skills, the frequency and duration of sessions, and the different benefits of the varied forms of such interventions. The long-term effects of these interventions are still not

entirely clear. Follow-up studies are warranted to examine whether these benefits can be maintained. Further studies can also be replicated in different gender samples or patients in different stages to identify any differential effects on these populations. Furthermore, the neurophysiological mechanism of mind–body interventions is a major challenge for basic research. By identifying the neurobiological changes and connecting them to clinical outcomes, we may better understand how these interventions work at the brain level. Future research with proper controls and methods is needed to investigate both common and differential mechanisms underlying different types of meditation practice.

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