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The influence of mindfulness training in virtual reality on symptom severity and cognitive functioning of patients with schizophrenia and schizoaffective psychosis – a case series pilot study

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Summary

Aim. An idiographic evaluation of the effectiveness of including Mindfulness Skills Training in Virtual Reality (MST-VR) in the treatment of patients with schizophrenia disorders and its comparison with the results of a group effects analysis.

Material and method. Twenty-five patients with schizophrenia and schizoaffective psychosis were assessed at 4-week intervals (one month before training, at the beginning and the end of training) using: Positive and Negative Syndrome Scale (PANSS-6), Quick Inventory of Depressive Symptomatology (QIDS), Beck Depression Inventory (BDI®-II), Beck Anxiety Inventory (BAI), State-Trait Anxiety Inventory (STAI), Perceived Stress Scale (PSS-10) and Addenbrooke's Cognitive Examination III (ACE-III). The Reliable Change Index (RCI) was used for statistical evaluation, and Cohen's d was used to assess effect size.

Results. Twenty patients (80%) achieved improvements in the severity of general symptoms, positive and negative symptoms, stress, anxiety, depression, and cognitive functioning. Individual patients showed deterioration in anxiety (2 patients, 8%) and stress (1 patient, 4%).

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The RCI method showed greater sensitivity in detecting changes than standard monographic statistical methods.

Conclusions. The MST-VR intervention as an adjunctive treatment for patients with schizophrenia and schizoaffective psychosis is safe and beneficial. The RCI method is valuable in assessing the dynamics of individual patient outcomes.

Key words: virtual reality, schizophrenia and schizoaffective psychosis, idiographic method

Introduction

The treatment of people with non-affective psychosis, focused on symptom reduction through pharmacotherapy and various types of psychotherapy, is often insufficient [1-3]. With symptoms usually persisting despite standard treatment, new psychotherapeutic approaches based on symptom acceptance and mindfulness techniques are being developed [4, 5]. The third wave of cognitive-behavioral therapies proposes mindfulness-based interventions which are intended to lead to a change in the patient's maladaptive responses to emerging symptoms of mental disorders into non-judgmental and accepting ones. This, in turn, leads to a reduction in stress levels, which ultimately results in a decrease in the severity of the symptoms themselves.

A wealth of data has accumulated supporting the effectiveness of mindfulness--based interventions in the treatment of various disorders, such as personality disorders (especially borderline), obsessive-compulsive disorder, depression, anxiety disorders, chronic pain, addiction, eating disorders, ADHD, PTSD, and Alzheimer's disease, among others [6]. For many years, there have also been attempts to adapt mindfulness--based interventions as a complementary therapy for the treatment of psychotic and depressive symptoms among patients with schizophrenia [7-11]. Earlier studies recommended caution and expressed reservations about the use of mindfulness-based interventions in individuals diagnosed with, or susceptible to, schizophrenia spectrum disorders [9, 10, 12-14]. It has been argued that the classic form of mindfulness training – which typically takes place in silence – may act as a trigger for the exacerbation of both negative and positive symptoms [9].

In recent years, many meta-analyses have been published demonstrating the effectiveness of mindfulness-based interventions for this group of patients [15-18]. It should be stressed that mindfulness-based interventions were effective in psychotic patients, with small to moderate effects that were relatively durable, lasting at least 3 to 6 months [3]. Favorable and more consistent results were found for negative rather than positive symptoms. These results allow us to assume that mindfulness practices can be applied to psychotic patients, provided that appropriate modifications to mindfulness protocols are made to ensure safety. The most essential element of these adaptations, as evidenced by numerous meta-analyses, is the creation of a safe environment. Virtual Reality (VR) appears to be an environment in which the advantages of attentive observation can be combined with the constraints of disorder-specific procedures [1-3]. In the case of patients with schizophrenia who struggle with distractibility and cognitive difficulties, it is hypothesized that VR will enable them to focus more fully on the therapeutic process [4, 5].

The natural environment presented in VR, serving as a background for mindfulness exercises, supports the use of cognitive resources limited by the disease. In such an environment, attentional fatigue is reduced, significantly improving the ability to concentrate [19].

Studies show that the effectiveness of practicing various mindfulness techniques in a VR environment depends on the degree of presence experienced [19]. For psychotic patients, the introduction of a safe, reproducible VR environment reduces the need to learn the therapeutic procedure, allowing them to focus on following instructions. These features of the VR environment, in the case of patients with schizophrenia, may positively influence motivation to undertake and continue therapeutic intervention [4, 5]. The results so far point to the particular usefulness – in addition to the VR environment – of psychoeducation, the trainer's personality, and the regularity of home practice [1, 3]. The positive role of psychoeducation and the trainer's personality is not only to explain the nature of the illness and offer ways to manage symptoms but, above all, to provide patients with a safe and supportive environment for calmly exploring their own experiences. Psychotic suffering, according to the conceptualization of mindfulness, is a consequence not only of the symptoms themselves, but above all of the person's reaction to these symptoms as they appear [9].

In our first publication, we demonstrated the positive effect of our original program combining mindfulness training conducted in virtual reality (MST-VR) with elements of psychoeducation on the severity of both positive and negative psychotic symptoms (based on group-level comparison) [5]. At that time, only averaged results for the entire group were analyzed, without considering individual patient outcomes. Encouraged by these results, we decided to examine how the therapeutic procedure we used affects individual patients by employing an alternative idiographic method based on the Reliable Change Index (RCI), which allows for the assessment of change at the individual level.

Material

The subjects were recruited from a network of Krakow centers linked by a common rehabilitation program: the Day Ward of Rehabilitation and Psychosis Treatment, the Adult Psychiatry Clinic of the University Hospital in Krakow, and the Community Day Care Home run by the Association for the Development of Psychiatry and Community Care. The study was approved by the Bioethics Committee of the Jagiellonian University Medical College (approval no. 1072.6120.11.2021, dated February 17, 2021).

The study enrolled 42 adults aged 18-50 years with a diagnosis of schizophrenia or schizoaffective disorder, established by an experienced clinician based on ICD-10 diagnostic criteria. Twenty-five participants (59.5%) completed the full training and underwent all three assessments. The study group had a mean age of 39.3 years (SD = 11.1), and 60% of the participants were male. All participants were receiving regular pharmacological treatment; with the exception of one patient (monotherapy with a first-generation antipsychotic drug), all were taking second-generation antipsychotics. In addition, four individuals (16%) were receiving mood stabilizers (Lithium,

Tegretol, Depakine) and 10 subjects (40%) were taking antidepressants. A more detailed description of the study group can be found in a previous publication [5].

Methods

The therapeutic intervention included 12 sessions of mindfulness training in VR, conducted three times per week over four weeks. A repeated-measures design was used. Each study participant completed the first series of tests and questionnaires (T1) and remained in standard treatment (Treatment as Usual – TAU) for four weeks. The second measurement (T2) took place just before the beginning of the training, i.e., the MTS-VR intervention, which lasted four weeks and was followed by the final measurement (T3) [5].

The abbreviated PANSS-6 scale [20, 21] and the Addenbrooke's Cognitive Examination III (ACE III) cognitive function scale [22] were used during each of the three clinical assessments conducted by experienced clinicians. The subjects filled in self-report questionnaires: the QIDS-SR depression severity scale [23], Beck Depression Inventory (BDI) [24], Beck Anxiety Inventory (BAI) [25], Perceived Stress Scale (PSS-10) [25], and the State-Trait Anxiety Inventory (STAI) [26].

Statistical methods

Descriptive statistics were used to characterize the study group. The Reliable Change Index (RCI) for repeated measures and Cohen's *d* were used to assess the magnitude of changes in symptoms, emotions, and cognitive functioning [27-30]. Due to the small number of subjects, an 80% confidence interval was used to evaluate the significance of individual changes [27].

Compared to the previous publication, the current study applies a different analytical strategy to measure change in each patient individually. As it is an idiographic method, the RCI allows for estimating the percentage of subjects who showed statistically significant change after the intervention. The main advantage of this analytical strategy is its ability to identify significant changes in various indicators at the level of a single patient [28-30]. An additional advantage of the RCI is that the method makes it possible to calculate the probability that an observed change is due to measurement error or to the application of a specific therapeutic intervention [31-33]. It should be noted that the RCI is widely used to assess the effectiveness of various therapeutic interventions [22, 34], as well as in the social sciences [35].

Cohen's *d* [36] was used to measure the effect size of the test–retest difference. When interpreting the effect size, general guidelines for cutoff points were applied, i.e., small ($d \geq 0.2$), moderate ($d \geq 0.5$), and large ($d \geq 0.8$).

Results

In the evaluation of the intervention (Table 1), statistically significant changes were observed – listed in order of estimated effect size – in the following areas: cognitive

improvement on the ACE (d = 0.51; improvement in 3 patients [12%]), decrease in anxiety on the BAI (d = 0.38; improvement in 3 patients [12%]), decrease in positive psychotic symptoms (d = 0.35; improvement in 4 patients [16%]), decrease in general psychotic symptoms on the PANSS-6 (d = 0.34; improvement in 10 patients [40%]), reduction in depressive symptoms on the QIDS (d = 0.32; improvement in 6 patients [24%], worsening in 3 patients [12%]), decrease in anxiety severity on the STAI (d = 0.30; improvement in 3 patients [12%]; worsening in 2 patients [8%]), reduction in depressive symptoms on the BDI (d = 0.28; improvement in 5 patients [20%]), reduction in perceived stress on the PSS-10 (d = 0.27; improvement in 6 patients [24%], worsening in 3 patients [12%]), and decrease in negative psychotic symptoms (d = 0.21; improvement in 1 patient [4%]).

Most patients benefited after participating in MST-VR (T2 vs. T3) compared to TAU (T1 vs. T2). Twenty patients (80%) showed significant improvement on at least one measure. Of these, nine patients (36%) experienced positive changes in more than one area: one patient in six areas, one in five, one in four, four in three, and two in two areas.

Table 1. **Significant (improvement and worsening) and nonsignificant changes (trends) at the 80% confidence level in the evaluation of the intervention (MST-VR; T1-T3) and standard therapy only (TAU; T1-T2)**

Group	TAU			MST-VR		
Scale	*d*	+	-	*d*	+	-
ACE III	0.18	1 (10)	0 (10)	0.51	3 (17)	0 (5)
PANSS-6	0.02	2 (7)	4 (5)	0.34	10 (13)	0 (2)
Posit.	0.03	1 (7)	3 (7)	0.35	4 (18)	0 (3)
Negat.	0.01	0 (6)	0 (6)	0.21	1 (21)	0 (3)
BDI	0.08	1 (10)	2 (6)	0.28	5 (14)	0 (6)
QIDS	0.18	2 (11)	0 (6)	0.32	6 (10)	3 (6)
BAI	0.27	5 (10)	0 (5)	0.38	3 (14)	0 (8)
STAI	0.26	1 (15)	0 (6)	0.30	3 (17)	2 (3)
PSS-10	0.25	4 (9)	1 (7)	0.27	6 (13)	3 (3)

d – Cohen's d effect size; [+] – number of participants who showed statistically significant clinical improvement (trends toward improvement presented in brackets); [-] – number of participants who showed statistically significant clinical deterioration (trends toward deterioration presented in brackets)

Significant symptomatic worsening occurred in 4 patients (16%). The adverse changes were found only in the severity of anxiety and stress. Among these patients, all but one showed improvement on at least one other measure. Only one patient (4%) experienced a significant deterioration in BAI scores without any improvement or trend toward improvement. One patient (4%) showed a substantial worsening on three scales (BAI, STAI, PSS), but at the same time demonstrated significant improvement on the ACE scale.

The results, including statistically insignificant favorable changes (improvement trends), show that in all indicators except QIDS, improvement tendencies were observed in a greater number of patients after the intervention (MST-VR) compared to TAU. The opposite phenomenon was observed for deterioration trends – in all indicators except BAI, fewer patients showed tendencies toward deterioration after MST-VR than during the TAU period.

In summary, the results indicate that MST-VR training was clearly more effective than TAU. This applies both to the number of patients who showed statistically significant improvement, and to the magnitude of the effect size.

Discussion

The analyses showed that the idiographic analytical strategy, compared to group-based analyses, captures a much broader range of the impact of the training [5]. The novelty obtained using a different analytical strategy is that including mindfulness practices conducted in a VR environment significantly enhances the effects of TAU. The results are consistent with studies of mindfulness-based interventions without the use of VR, according to which such an intervention, coupled with the continuation of standard treatment, improves overall symptomatology, including positive and negative symptoms, level of functioning, and illness awareness [37]. The results are also consistent with meta-analyses [1, 3, 38, 39], which indicate that incorporating mindfulness elements into standard therapy improves overall symptomatology. However, some negative symptoms may persist for 3 to 6 months [3].

The new analytical strategy confirmed the claim that incorporating mindfulness elements conducted in a VR environment is not only effective but, above all, safe. This phenomenon is mainly indicated by the results, which revealed that clinically significant negative changes occurred in only four patients, with three simultaneously achieving significant benefits on at least one scale. In those patients who experienced substantial symptomatic worsening, the negative changes appeared only in the severity of anxiety and stress. No deterioration was observed in depressive or psychotic symptom scales. This suggests that even if the increased severity of anxiety and stress in some subjects was due to the therapeutic intervention, it did not negatively affect the core symptoms of schizophrenia or depression. To some extent, the results of the present study weaken the weight of criticisms directed at mindfulness-based interventions – namely, that they may exacerbate symptoms in cases of psychosis [40-42].

It should be noted that only one patient, in whom deterioration was observed on one scale, did not experience improvement on any other scale. The lack of any improvement in this patient may have been due to the high severity of psychotic symptoms (26 points on the PANSS total scale) and in particular, negative symptoms (15 points on the PANSS negative symptoms scale). The reasons for the lack of improvement may have been both the high level of positive symptoms, which significantly impeded the patient's ability to focus on the training, and the presence of negative symptoms, which reduced his motivation to participate and thus led to limited engagement in the sessions.

Using an idiographic strategy also made it possible to uncover adverse trends, the identification of which may help prevent the negative effects of mindfulness-based interventions through countermeasures (e.g., psychoeducation), thereby increasing the safety of the method. Due to the relatively high variability in baseline measurements, it is not possible to determine whether any underlying patient characteristics increase the risk of deterioration following such an intervention. The observed increases in anxiety and stress in some individuals were likely related to the training's impact on temporarily intensifying emotions triggered by exposure to previously avoided stimuli (e.g., negative emotional states or thoughts). This phenomenon is confirmed by many studies and by the views of experienced mindfulness practitioners, who report that some individuals – especially at the beginning of practice – may experience increased levels of stress, anxiety, or anger [43-45].

Temporary increases in these symptoms are very common during mindfulness training and affect not only individuals from clinical populations but also non-clinical participants. These side effects particularly intensify between the third and fourth week of mindfulness practice [6]. Many researchers emphasize that temporary increases in stress and anxiety indicators can be beneficial for developmental dynamics and are associated with growing self-insight. However, in the case of prolonged persistence of elevated levels of stress or anxiety, it is recommended that the patient withdraw from this type of therapy, receive supportive care, or engage in individual therapy [46].

The positive effects of our research strategy were revealed especially in terms of depressiveness. This fact is particularly noteworthy in the context of the results of previous studies, where such an effect was not demonstrated [5]. Although the significant clinical effects observed were again small in both effect size and the number of patients, they were notably elevated among patients who showed improvement trends – positive trends were absent in six (BDI) or nine (QIDS) patients. It should be noted that this result is consistent with the findings of other studies [1, 3, 38, 39], and is significant insofar as a reduction in depressiveness positively increases the patient's motivation to engage in therapy [3].

Positive effects also appeared in cognitive functioning. Although a clinically significant change was achieved in only two patients, positive trends were found in the majority of participants, i.e., 20 in total (no trend toward improvement was shown in five patients). This result is important, as cognitive functions in patients with psychotic disorders are typically impaired and particularly resistant to therapeutic interventions [7, 8, 11]. This phenomenon is consistent with observations reported in the literature, in which mindfulness-based interventions, even without the use of VR, effectively improved cognitive functioning [47].

In terms of anxiety and stress, both favorable and unfavorable effects were observed. The mindfulness-based interventions induced clinically significant improvement in two patients regarding anxiety and in four patients regarding stress, but also caused worsening in one and two patients, respectively. Similar effects were observed for trends toward improvement (ten patients showed improvement trends in anxiety, and seventeen in stress) and worsening (three patients showed worsening trends in anxiety, and six in stress). This suggests the need for caution when implementing mindfulness

practices in the treatment of psychotic patients, as stress and anxiety may induce or exacerbate symptoms [1, 9, 14]. However, such a phenomenon was not revealed in this study.

In conclusion, it should be stated that for psychotic patients, the inclusion of mindfulness elements appears to be not only beneficial but also safe. Safety seems to be influenced primarily by the immersive VR environment and, as evidenced by some research findings, by the empathic presence of the trainer [3] and psychoeducation [48]. For this reason, we plan to incorporate psychoeducation in an expanded form in future studies of mindfulness training designed for psychotic patients in virtual reality.

Conclusions

The idiographic analytic strategy used in this study indicates that the developed mindfulness intervention can be safely yet effectively implemented in patients with schizophrenia. Two key elements seem to determine the safety and effectiveness of interventions based on various mindfulness techniques: the use of an immersive VR environment and an empathetic and accepting attitude of the trainer or therapist as a companion in the struggle with the disease. Such a strategy can significantly contribute to overcoming temporary crises, strengthening the patient's motivation, and achieving greater benefits.

It should be stressed that when designing and conducting interventions for patients with schizophrenia, special attention must be paid to the psychiatric evaluation of those qualified for therapy. In addition, an essential element for ensuring patient safety and improving the positive efficacy of such treatments will be the monitoring and control of stress and anxiety levels, which tend to increase especially at the very beginning.

In the present study, it is inappropriate to discuss the effects produced by mindfulness techniques alone, since they were implemented alongside standard treatment. However, the fact remains that mindfulness-based interventions not only did not harm patients but, in most cases, clinically significantly supported the effects of their treatment.

The results require confirmation in a targeted study conducted on a larger group, with a control group and a longer intervention period. This is especially advisable because, with mindfulness-based interventions, stable therapeutic effects are usually observed only after 8 weeks of systematic practice. Although beneficial effects may appear from the very first training, estimating these effects requires advanced neuroimaging tools.

Limitations

The formulation of the intervention method used with patients with schizophrenia is associated with several limitations. The first limitation is the short duration of the intervention. In short-term interventions, changes are observed mainly in measurements taken immediately after implementation, particularly in the area of anxiety.

Another limitation is the small sample size, which consisted mostly of chronic patients with a severe course of illness. Admittedly, preliminary data suggest that mindfulness training can also lead to a reduction in the severity of positive symptoms in chronic patients, and such an effect was observed after three weeks of intervention.

An additional limitation is the reliance primarily on self-report tools and the lack of assessment of the physiological components of stress. Additional evaluation in these areas would have allowed for a more objective assessment of changes. In the case of cognitive and psychotic symptoms, the clinician was not blinded and knew which phase of the study the patient was in, which may have led to observer bias.

Not least among the limitations was the absence of a control group receiving only the standard intervention. Therefore, it is not possible to determine precisely whether the use of VR produced additional positive therapeutic effects, whether the effects were caused by the mindfulness intervention alone, or by the therapeutic process as a whole. This issue warrants further research comparing VR-based interventions with a control group not exposed to VR.

References

1. Jacobsen P, Choksi T, Sawyer K, Maximen C, Harding E, Richardson M. *Home practice in mindfulness-based interventions for psychosis groups: A systematic review and qualitative study.* BMC Psych. 2022; 10(1): 9.
2. Leichsenring F, Steinert C, Rabung S, Ioannidis JPA. *The efficacy of psychotherapies and pharmacotherapies for mental disorders in adults: An umbrella review and meta-analytic evaluation of recent meta-analyses.* World Psychiatry 2022; 21(1): 133–145.
3. Liu YC, Li IL, Hsiao FH. *Effectiveness of mindfulness-based intervention on psychotic symptoms for patients with schizophrenia: A meta-analysis of randomized controlled trials.* J. Adv. Nurs. 2021; 77(6): 2565–2580.
4. Kruk D, Plencler I, Walecki P, Daren A, Stankiewicz P, Proniewska K et al. *Application of 360° virtual reality videos in the assessment of paranoia in schizophrenia patients: A pilot study.* Psychiatr. Pol. 2023; 57(2): 325–338.
5. Plencler I, Kruk D, Daren A, Stankiewicz P, Nowak A, Radoń S et al. *The effects of mindfulness-based training in virtual reality on psychotic symptoms, mood, and cognitive functioning – A pilot study.* Psychiatr. Pol. 2024; 58(2): 289–302.
6. Radoń S. *Czy medytacja naprawdę działa?* Kraków: WAM; 2017.
7. Chadwick P, Hughes S, Russell D, Russell I, Dagnan D. *Mindfulness groups for distressing voices and paranoia: A replication and randomized feasibility trial.* Behav. Cogn. Psychother. 2009; 37(4): 403–412.
8. Chadwick P, Taylor KN, Abba N. *Mindfulness groups for people with psychosis.* Behav. Cognit. Psychother. 2005; 33(3): 351–359.
9. Pinto A. *Mindfulness and psychosis.* In: Didonna F, ed. *Clinical handbook of mindfulness.* New York: Springer; 2009. pp. 339–368.
10. Pinto A, Kingdon D, Turkington D. *Cognitive Behaviour Therapy for psychosis: Enhancing the therapeutic relationship to improve the quality of life.* In: Simos G, ed. *CBT – A guide for the Practicing Clinician – Vol. II.* East Sussex: Routledge; 2009.

11. Wilkos E, Tylec A, Kułakowska D, Kucharska K. *Najnowsze kierunki terapeutyczne w rehabilitacji pacjentów z zaburzeniami psychicznymi.* Psychiatr. Pol. 2013; 47(4): 621–634.
12. Bach P, Gaudiano B, Hayes SC, Herbert JD. *Acceptance and commitment therapy for psychosis: Intent to treat, hospitalization outcome and mediation by believability.* Psychosis 2013; 5(2): 166–174.
13. Gaudiano B, Visser K, Thompson E. Psychosis and schizophrenia. In: Hupp S, Santa Maria C, eds. *Pseudoscience in therapy: A skeptical field guide.* Cambridge: Cambridge University Press; 2023. pp. 261–281.
14. Radoń S. *Psychoza a medytacja.* St. Psych. 2016; 15(2): 23–37.
15. Hodann-Caudevilla RM, Díaz-Silveira C, Burgos-Julián FA, Santed MA. *Mindfulness-based interventions for people with schizophrenia: A systematic review and meta-analysis.* Int. J. Environ. Res. Public. Health 2020; 17(13): 4690.
16. Lazzari C, Kotera Y, Rabottini M. *Should mindfulness-based cognitive therapy be used for psychosis? A systematic review of the literature and meta-analysis.* Riv. Psichiatr. 2022; 57(5): 203–211.
17. Lincoln TM, Pedersen A. *An overview of the evidence for psychological interventions for psychosis: Results from meta-analyses.* Clin. Psychol. Eur. 2019; 1(1): 1–23.
18. Yip ALK, Karatzias T, Chien WT. *Mindfulness-based interventions for non-affective psychosis: A comprehensive systematic review and meta-analysis.* Ann. Med. 2022; 54(1): 2339–2352.
19. Annerstedt M, Jönsson P, Wallergård M, Johansson G, Karlson B, Grahn P et al. *Inducing physiological stress recovery with sounds of nature in a virtual reality forest – Results from a pilot study.* Physiol. Behav. 2013; 118: 240–250.
20. Østergaard SD, Lemming OM, Mors O, Correll CU, Bech P. *PANSS-6: A brief rating scale for the measurement of severity in schizophrenia.* Acta Psychiatr. Scand. 2016; 133(6): 436–444.
21. Wojciechowska K, Walęcka M, Szmyd J, Wichniak A. *Simplified Interview for Negative and Positive Symptoms (SNAPSI) and the PANSS-6 scale – Polish language adaptation and application.* Post. Psychiatr. Neurol. 2020; 29(4): 215–223.
22. Hsieh S, Schubert S, Hoon C, Mioshi E, Hodges JR. *Validation of the Addenbrooke's Cognitive Examination III in frontotemporal dementia and Alzheimer's disease.* Dement. Geriatr. Cogn. Disord. 2013; 36(3–4): 242–250.
23. Rush AJ, Trivedi MH, Ibrahim HM, Carmody TJ, Arnow B, Klein DN et al. *The 16-item quick inventory of depressive symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR): A psychometric evaluation in patients with chronic major depression.* Biol. Psychiatry 2003; 54(5): 573–583.
24. Beck AT, Steer RA, Brown G, Łojek E, Stańczak J,tł. Jaworowka A, *BDI-II Inwentarz Depresji Becka – Wydanie drugie.* Warszawa: Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego; 2019.
25. Cohen S, Kamarck T, Mermelstein R. *Perceived Stress Scale.* American Psychological Association; 2014. http://doi.apa.org/getdoi.cfm?doi=10.1037/t0288-000 (retrieved: 14.07.2022).
26. Spielberger CD. *State-Trait Anxiety Inventory for Adults.* American Psychological Association; 2012. http://doi.apa.org/getdoi.cfm?doi=10.1037/t06496-000 (retrieved: 14.07.2022).
27. Machin D, Tan SB, Tan SH. *Sample sizes for clinical, laboratory and epidemiology studies.* London: Wiley-Blackwell; 2018.
28. Blampied MN. *Reliable change and the reliable change index: Still useful after all these years?* Cogn. Behav. Ther. 2022; 15: e50.

29. Iraurgi I, Penas P, Gorbeña S, Montero M, Trujols J. *Outcomes assessment: Reliable Change Index (RCI) in assessing health outcomes in clinical practice.* Eur. Psychiatry 2017; 41(S1): S796–S796.
30. Jacobson NS, Truax P. *Clinical significance: A statistical approach to defining meaningful change in psychotherapy research.* J. Consult. Clin. Psychol. 1992; 59(1): 12–19.
31. Hill SW. *Components and methods of evaluating reliable change in cognitive function.* In: Pearson CM, Ecklund-Johnson E, Gale SD, eds. *Neurosurgical neuropsychology: The practical application of neuropsychology in the neurosurgical practice.* Cambridge: Elsevier Academic Press; 2019. pp. 39–61.
32. Iverson GL. *Interpreting change on the WAIS-III/WMS-III in clinical samples.* Arch. Clin. Neuropsychol. 2001; 16(2): 183–191.
33. Iverson GL, Lovell MR, Collins MW. *Interpreting change on ImPACT following sport concussion.* Clin. Neuropsychol. 2003; 17(4): 460–467.
34. Marx BP, Lee DJ, Norman SB, Bovin MJ, Sloan DM, Weathers FW et al. *Reliable and clinically significant change in the clinician-administered PTSD Scale for DSM-5 and PTSD Checklist for DSM-5 among male veterans.* Psychol. Assess. 2022; 34(2): 197–203.
35. Tyburski E, Kerestey M, Kerestey P, Radoń S, Mueller ST. *Assessment of motor planning and inhibition performance in non-clinical sample – Reliability and factor structure of the Tower of London and Go/No Go Computerized Tasks.* Brain Sci. 2021; 11(11): 1420.
36. Lakens D. *Equivalence tests: A practical primer for t tests, correlations, and meta-analyses.* Soc. Psychol. Pers. Sci. 2017; 8(4): 355–362.
37. Zeidan F, Johnson SK, Diamond BJ, David Z, Goolkasian P. *Mindfulness meditation improves cognition: Evidence of brief mental training.* Conscious. Cogn. 2010; 19(2): 597–605.
38. Khoury B, Lecomte T, Gaudiano BA, Paquin K. *Mindfulness interventions for psychosis: A meta-analysis.* Schizophr. Research 2013; 150(1): 176–184.
39. Tao TJ, Hui CLM, Lam BST, Ho ECN, Hui PWM, Suen YN et al. *Mindfulness meditation for Chinese patients with psychosis: A systematic review and meta-analysis.* Schizophr. Res. 2021; 237: 103–114.
40. Kuijpers HJH, Heijden van der FMMA, Tuinier S, Verhoeven WMA. *Meditation-induced psychosis.* Psychopathology 2007; 40(6): 461–464.
41. Sethi S, Subhash C. *Relationship of meditation and psychosis: Case studies.* Aust. N. Z. J. Psychiatry 2003; 37(3): 382.
42. Yorston G. *Mania precipitated by meditation: A case report and literature review.* Ment. Health Relig. Cult. 2001; 4(2): 209–213.
43. Brewer JA, Worhunsky PD, Gray JR, Tang YY, Weber J, Kober H. *Meditation experience is associated with differences in default mode network activity and connectivity.* Proc. Natl. Acad. Sci. U S A 2011; 108(50): 20254–20259.
44. Fox KCR, Spreng RN, Ellamil M, Andrews-Hanna JR, Christoff K. *The wandering brain: Meta-analysis of functional neuroimaging studies of mind-wandering and related spontaneous thought processes.* Neuroimage 2015; 111: 611–621.
45. Hasenkamp W, Wilson-Mendenhall CD, Duncan E, Barsalou LW. *Mind wandering and attention during focused meditation: A fine-grained temporal analysis of fluctuating cognitive states.* Neuroimage 2012; 59: 750–760.
46. Radoń S. *Medytacja. Pomiędzy teorią a praktyką.* Kraków: WAM; 2023.

47. Daren A, Mętel D, Błądziński P, Kalisz A, Pionke R, Krężołek M et al. *The relationships of need for closure dimensions with psychotic-like experiences and jumping to conclusions. A study of a large cross-population sample.* Psychiatr. Pol. 2021; 55(2): 287–307.
48. Chien WT, Bressington D, Yip A, Karatzias T. *An international multi-site randomized controlled trial of a mindfulness-based psychoeducation group programme for people with schizophrenia.* Psych. Med. 2017; 47(12): 2081–2096.

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