

REDUCTION IN SYMPTOMS OF POSTTRAUMATIC STRESS DISORDER AND DEPRESSION IN UKRAINIAN REFUGEES PRACTICING TRANSCENDENTAL MEDITATION

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Abstract

Introduction. Following the full-scale Russian invasion of Ukraine, there has been a substantial increase in the need for accessible, rapid-acting, and non-pharmacological approaches to alleviate symptoms of post-traumatic stress disorder and depression among Ukrainian refugees. One potentially useful intervention is the Transcendental Meditation program.

Aim. To assess the effectiveness of the Transcendental Meditation program in reducing symptoms of post-traumatic stress disorder and depression in Ukrainian refugees residing in Germany.

Materials and methods. The study included 80 Ukrainian refugees: 40 participants in the intervention group who practiced Transcendental Meditation for 60 days and 40 participants in the non-practicing control group. Symptoms of post-traumatic stress disorder were assessed using the PCL-5 and IES-R scales, while depressive symptoms were measured using the BDI-II at baseline and after 30 and 60 days. Parametric and non-parametric statistical methods were applied for data analysis.

Results. As early as 30 days after the start of the intervention, the meditation group demonstrated a statistically significant reduction in symptoms of post-traumatic stress disorder and depression compared with baseline values. The proportion of participants with probable post-traumatic stress disorder decreased from 60.0% to 2.5%, and after 60 days no participant in this group remained above the diagnostic cutoff. At both 30 and 60 days, the intervention group showed statistically significantly better PCL-5, IES-R, and BDI-II scores than the control group. In the control group, no significant reduction in post-traumatic stress disorder symptoms was observed, whereas depressive symptoms tended to worsen by the end of follow-up.

Conclusions. Regular practice of the Transcendental Meditation program is associated with a rapid and statistically significant reduction in symptoms of post-traumatic stress disorder and depression among Ukrainian refugees. The program may be considered a promising adjunctive or alternative non-pharmacological approach within psychosocial support systems; however, further research in larger samples is required.

Keywords: post-traumatic stress disorder, depression, Ukrainian refugees, Transcendental Meditation, psychosocial support

INTRODUCTION

Since the beginning of the Russian invasion of Ukraine, millions of Ukrainians have been forced to flee from the war and resettle within Ukraine or leave

their country. Many of them suffer from symptoms of posttraumatic stress disorder (PTSD), a clinical condition that people can develop after having been exposed to life-threatening or profoundly disturbing events. PTSD is characterized by four clusters of symptoms [1] occurring

in reaction to a traumatic event: (1) re-experiencing (e.g., intrusive memories of the trauma, flashbacks, nightmares), (2) avoidance (of thoughts and feelings, or of external triggers related to the trauma), (3) negative alterations in cognition/mood (e.g., memory loss, enduring negative emotions, self-blame), and (4) alterations in arousal and reactivity (e.g., restlessness, irritability, concentration and sleep problems). If left untreated, the condition can chronify and cause problems for years or even decades to come [27], putting great strain on the affected persons as well as their families and society as a whole [19].

Major depressive disorder is a mood disorder that commonly occurs after exposure to trauma, either alone or together with PTSD [11, 28]. It is characterized by pervasive low mood and loss of interest or pleasure in almost all activities, along with other symptoms such as fatigue, slowing down of thought, and low self-esteem [1]. Depressive disorders may significantly impair social functioning and ability to work, and pose a high economic burden on society due to both direct and indirect costs [12].

Data from general population samples collected in Kharkiv and Lviv, as well as throughout Ukraine after the beginning of the war in 2014, suggest that 65% of internally displaced people (IDPs) had been directly exposed to war trauma, and the prevalence of PTSD was significantly higher among IDPs compared to urban-dwelling people, as well as compared to those with Russian identity [17]. PTSD prevalence in IDPs was 32% and depression prevalence was 22%, and 74% of those in need of treatment did not receive any, showing a large treatment gap in mental health care and psychosocial support in Ukraine [31]. Among Ukrainian civilians who were displaced following the Russian invasion of 2022, displacement was again found to be associated with higher rates of PTSD; however there was no difference in the PTSD prevalence between those who had been forced to resettle within Ukraine and those who had left their home country, and the average prevalence of PTSD among displaced Ukrainians was 30.8% [8]. Regarding depression, preliminary studies of Ukrainian refugees from the 2022 invasion in 11 European countries showed that while 2.7% reported to have displayed depression previously, after the forced resettlement 16.4% reported strong manifestations of depression, 2.7% felt exhausted and disorganized due to new manifestations of depression, and another 37.0% stated to have developed symptoms of depression [20-21].

Consequently, Ukraine and countries hosting Ukrainian refugees are faced with a greatly increased demand for treatment of both PTSD and depression. This demand often exceeds the existing treatment capacities and is further aggravated by the fact that in receiving countries treatment needs to be provided in or translated into Ukrainian or Russian language. Within Ukraine,

the supply of therapeutic care is not only impaired by the ongoing acts of war, but under conditions of a sharp increase in mental and behavioral disorders due to the Russian invasion, the system of psychiatric care and psychological support as such turned out to be in need of revision [35]. Psychological help in Ukraine is mostly psychiatric [22], therefore the implementation of unified programs of self-help and psychotherapy is extremely urgent. Moreover, the system of therapeutic assistance should be based on the principles of a comprehensive approach that integrates various areas of medical and socio-psychological knowledge and practices [33].

Considering these problems, the Transcendental Meditation (TM) program may be a viable and adjunctive treatment option, and a probable answer to at least some of the requirements of the current situation. TM is a simple and effortless relaxation technique which is practiced twice daily for 15-20 minutes while sitting comfortably with eyes closed. It induces a psychophysiological state of «restful alertness» [3] which is characterized by the experience of stillness, stability, and order, as well as deep physiological rest shown in decreased metabolism, heart rate, and respiratory rate [34]. TM has been found to improve symptoms of depression in employees [14] and university students [24] and to significantly lower posttraumatic stress in various samples across different cultural backgrounds, such as veterans [7, 15, 18, 26, 32], active duty military personnel [4, 5], refugees [29, 30], prison inmates [23, 25], university students [2], and natural disaster survivors [36]. Significant improvements in PTSD symptoms have been found after a few weeks of practice already, and regarding its efficiency, TM has been shown to be significantly non-inferior to prolonged exposure therapy, with a larger percentage of participants positively responding to the TM program than to the therapy treatment [26]. The TM program is a non-invasive approach to treating PTSD, allowing the alleviation of symptoms without re-experiencing trauma [15]. In conclusion, it can be stated that the TM program is a promising and safe auxiliary or alternative treatment method for PTSD; however more research is needed to determine whether it also serves as an effective treatment for depression.

MATERIALS AND METHODS

The study examined the efficiency of the TM program to reduce symptoms of posttraumatic stress and depression in Ukrainian refugees in Germany by comparing a group practicing TM to non-practicing controls. Psychological measures for PTSD and depression were collected in both groups at baseline and at 30 and 60 days follow-up tests. All measures were administered in the Ukrainian version. The effect of the TM practice on the outcome variables was analyzed

within each group and between groups. The trial was conducted from May 2022 to September 2022 in the city of Lübeck, Northern Germany, and supervised by a certified Ukrainian psychotherapist. The Ethical Approval Commission at the Bogomolets National Medical University in Kyiv, Ukraine, approved the study.

Participant characteristics

The total sample consisted of 80 Ukrainian refugees who had fled to Germany after the outbreak of the war in Ukraine, 40 who practiced the TM program and 40 non-practicing controls. Criteria for participation included citizenship of Ukraine, attendance of all necessary meetings, and active participation in the study according to the instructions given. In addition, it was required that the subjects had not previously learned or practiced TM. Of the original 100 subjects, 10 in each group had to be excluded from the study due to incomplete data on the psychological measures, amounting to a total drop-out of 20.

Recruiting was done on social media, via information leaflets directly distributed at local refugee hostels and dormitories as well as in public places and public transportation, and by word-of-mouth-recommendation. For social networks (Facebook, Instagram, TikTok, Telegram), pages were created and updated regularly with written information as well as photo and video materials. All advertising was done in the Ukrainian language, which led to a high degree of trust in the study. In addition, a website was created in Ukrainian, English, and German versions, providing information about the study and the TM program. People were offered to learn the TM program for free to alleviate stress symptoms, and to receive practical advice for social adjustment if needed. A minimum severity of symptoms was not required to qualify for participation.

Research design

Individuals who were interested in learning the TM technique were invited in small groups to informational lectures at the local TM center, and afterwards decided whether they wanted to learn the TM program and partake in the study. Instruction to practice the TM technique was done by professional German TM teachers according to the official guidelines, with the assistance of a Ukrainian translator. On the three days after the initial instruction, subjects received check-ups for correct execution of the technique. Following that, they attended group check-ups every week and personal check-ups every two weeks. Participants were advised to practice 20 minutes of meditation twice daily in the mornings and evenings over the course of two months, and to write a short self-report at the end of each day. The self-assessment questionnaires were handed out to them at the respective testing times during the regular check-up meetings. The subjects filled out the questionnaires at home and returned them at the

next meeting. There were no drop-outs due to irregular practice of the TM program, or abandonment of the study before completion.

After the sampling of the TM group was finished at 50 subjects, a control group was created consisting of individuals who were interested in learning the TM program in the future. Psychological measures were sent to the controls via email at baseline and follow-up test times, and returned in the same electronic format. All subjects completed the study.

Measures

The Posttraumatic Stress Disorder Checklist in the version correspondent to the DSM-5 (PCL-5 [38]) consists of 20 items which are answered on a 5-point Likert scale ranging from 0 («not at all») to 4 («extremely»). Items are summed up for a total severity score (0-80) with a cutoff score of 31 [10]. In a sample of trauma-involved college students [9] the PCL-5 featured high internal consistency (Cronbach's $\alpha = .94$) and test-retest reliability ($r = .82$). Confirmatory factor analysis showed adequate fit with the 4-factor model in the DSM-5: $\chi^2(164) = 455.83$, $p < .001$, standardized root mean square residual (SRMR) = .07, root mean squared error of approximation (RMSEA) = .08, comparative fit index (CFI) = .86, Tucker-Lewis index (TLI) = .84.

The revised version of the Impact of Event Scale (IES-R [39]) is a 22-item questionnaire administered with a 4-point Likert scale ranging from 0 («not at all») to 3 («often»). In a treatment-seeking community sample with varying degrees of PTSD [13] the scale showed high internal consistency (Cronbach's $\alpha = .96$) and a high correlation with the PTSD Checklist ($r = .84$), with a cutoff score of 33 providing the best diagnostic accuracy. However, confirmatory factor analysis failed to support the proposed 3-factor structure. Exploratory factor analysis suggested either a single or a 2-factor solution (intrusion / hyperarousal and avoidance).

The Beck Depression Inventory-II (BDI-II [6]) consists of 21 questions with 4 possible answers each, ordered by increasing intensity and scored from 0 to 3. A score of 14-19 indicates mild depression, a score of 20-28 indicates moderate depression, and a score of 29-63 indicates severe depression. In a comprehensive review [37], the scale showed high internal consistency (Cronbach's α around .90) and test-retest reliability (r ranging from .73 to .96). Factor analysis showed a robust dimension of general depression with two sub-factors (cognitive-affective/somatic-vegetative).

Hypotheses

Based on previous findings [4-5, 7, 14-18, 36], we expected the following pattern of results: a distinct and significant reduction of reported symptoms within the TM group, and significantly lower reported symptoms in the

TM group compared to the control group at the 30-day post-test (hypothesis 1), an albeit less distinct, but still significant reduction of reported symptoms within the TM group, and significantly lower reported symptoms in the TM group compared to the control group at the 60-day post-test (hypothesis 2), and no significant change in reported symptoms in the control group (hypothesis 3).

Results Processing

All statistical analyses were performed and all graphs were created using SPSS Version 29 [16]. A total of 20 cases were excluded from the analysis because of missing data. For the remaining cases, sum scores were calculated for each measure at the baseline, 30-day, and 60-day tests, and change scores were computed by calculating the differences between measurements from baseline to 30 days, and from 30 to 60 days, respectively.

To test whether the practice of the TM program served as an effective method to reduce symptoms in comparison to no practice, 2x3 mixed analyses of variance (ANOVA) models containing a 2-level between-group factor (condition: TM vs. control) and a 3-level within-group factor (time: baseline, 30 days, 60 days) were calculated using the mean sum scores of the three measures. Simple main effects of both the between-subject and within-subject factors on the dependent variables were computed using one-way ANOVA and repeated measures ANOVA models, respectively. If indicated, robust tests were chosen for interpretation, and non-

parametric tests were run for additional confirmation of the results.

To analyze the effect of the TM program on changes in self-reported symptom severity, the mean change scores of the three measures were compared using 2x2 mixed ANOVA models with a 2-level between-group factor (condition: TM vs. control) and a 2-level within-group factor (time interval: 30 days–baseline vs. 60 days–30 days). Effects of both the between-subject and within-subject factors were computed using one-way ANOVA and repeated measures ANOVA models, respectively. If indicated, robust tests were chosen for interpretation, and the results were checked against non-parametric tests.

Prevalences of probable PTSD in the control and TM groups were analyzed within each group and between the two groups. Prevalences were based on PCL-5 sum scores using the cutoff score of 31.

RESULTS

Participant demographics

Participant demographics for the total sample and both the TM and control groups are displayed in Table 1.

There was no significant difference in age between groups ($t [69.08] = 1.22, p = 0.226$), however the groups significantly differed in distribution of sex ($z = 2.77, p = 0.006$) and prevalence of probable PTSD at baseline ($z = 2.68, p = 0.014$).

Table 1

Participant Demographics and Baseline Prevalence of Probable PTSD Measured with the PCL-5 Scale and Using a Cutoff Score of 31

Item	TM Group (n = 40)	Control Group (n = 40)	Total (N = 80)
Age (N)	<i>M</i> = 40.22 <i>SD</i> = 17.80	<i>M</i> = 36.87 <i>SD</i> = 11.94	<i>M</i> = 38.57 <i>SD</i> = 15.19
5-20 years	17.5% (7)0	2.5% (1)	10.0% (8)
21-30 years	12.5% (5)0	27.5% (11)	20.0% (16)
31-40 years	17.5% (7)0	32.5% (13)	25.0% (20)
41-50 years	27.5% (11)	27.5% (11)	27.5% (22)
51-60 years	5.0% (2)	5.0% (2)	5.0% (4)
61-70 years	5.0% (6)0	2.5% (1)	8.8% (7)
71-76 years	5.0% (2)	2.5% (1)	3.8% (3)
Gender (N)			
Female	75.5% (31)	47.5% (19)	62.5% (50)
Male	22.5% (9)0	52.2% (21)	37.5% (30)
Probable PTSD (N)			
PTSD (PCL ≥ 31)	60.0% (24)	32.5% (13)	46.3% (37)
no PTSD (PCL < 31)	40.0% (16)	67.5% (27)	53.8% (43)

Effects of the TM program on self-reported PTSD and depression symptom severity

Table 2 contains the means and standard deviations of the PCL-5, IES-R, and BDI-II sum scores.

Mixed ANOVA models yielded highly significant interaction effects between the time and group factors

on all outcomes: PCL-5 ($F[2, 156] = 23.02, p < 0.001$, partial $\eta^2 = .23$), IES-R ($F[2, 156] = 27.50, p < 0.001$, partial $\eta^2 = .26$), and BDI-II (Greenhouse-Geisser $F[1.68, 131.30] = 14.88, p < 0.001$, partial $\eta^2 = .16$). Figures 1, 2, and 3 depict the encountered pattern of results for the PCL-5, IES-R, and BDI-II sum scores, respectively.

Table 2

Means and Standard Deviations of PCL-5, IES-R, and BDI-II Sum Scores. Control Group n = 40, TM Group n = 40, Total Sample N = 80

Time	Condition	PCL-5		IES-R		BDI-II	
		M	SD	M	SD	M	SD
Baseline	Control	25.25	15.70	23.58	14.26	14.43	8.10
	TM	32.38	17.06	30.70	14.60	13.73	9.67
	Total	28.81	16.68	27.14	14.78	12.08	9.12
30 days	Control	24.55	22.02	23.50	18.17	12.30	14.35
	TM	13.85	8.57	14.58	11.27	6.18	4.81
	Total	19.20	17.45	19.04	15.68	9.24	11.07
60 days	Control	29.33	26.07	29.43	20.10	18.53	22.67
	TM	5.40	6.89	7.13	8.78	3.30	3.62
	Total	17.36	22.45	18.28	19.06	17.86	17.86

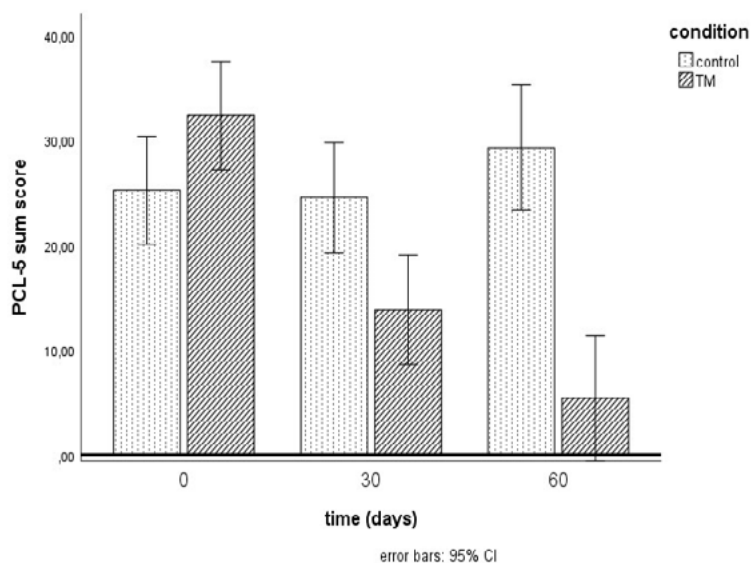


Figure 1. Changes in PTSD symptom severity, assessed with the PCL-5 scale, by treatment group: Comparison of the TM and control groups on mean PCL-5 sum scores after 0, 30, and 60 days.

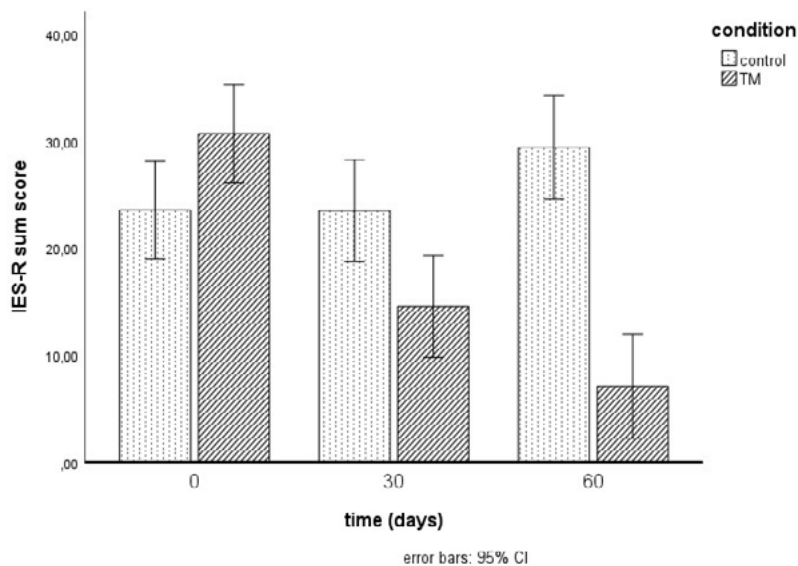


Figure 2. Changes in PTSD symptom severity, assessed with the IES-R scale, by treatment group: Comparison of the TM and control groups on mean IES-R sum scores after 0, 30, and 60 days.

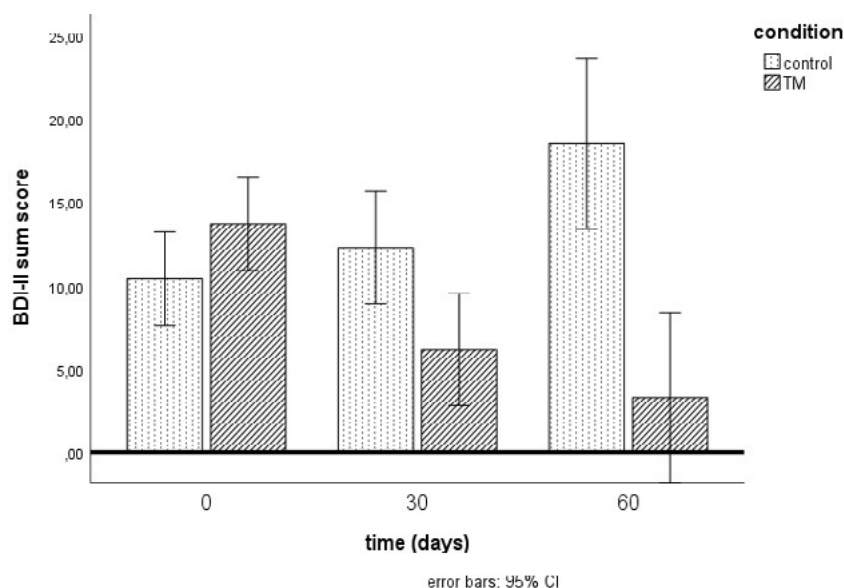


Figure 3. Changes in depression symptom severity, assessed with the BDI-II scale, by treatment group: Comparison of the TM and control groups on mean BDI-II sum scores after 0, 30, and 60 days.

With all outcomes, the requirement of variance homogeneity was not given consistently: PCL-5 ($F_s[1, 78]$ between 1.10 and 55.44, p s between .296 and <0.001), IES-R ($F_s[1, 78]$ between 0.26 and 33.76, p s between .610 and <0.001), BDI-II ($F_s[1, 78]$ between 1.48 and 73.79, p s between 0.228 and <.001). Since Box-Cox transformation

of variables featuring heteroscedasticity was not successful in all instances, follow-up analyses were conducted using robust and non-parametric procedures.

Tables 3 and 4 display the differences in mean sum scores between the control and TM groups, and within each group.

Table 3

Mean PCL-5, IES-R, and BDI-II Sum Score Differences Between the Control and TM Groups. p -values are Bonferroni-corrected

Time	PCL-5		IES-R		BDI-II	
	Δ (95% CI)	p	Δ (95% CI)	p	Δ (95% CI)	p
Baseline	7.13 (-0.18, 14.30)	0.056	7.13 (0.70, 13.55)	0.030	3.30 (-0.67, 7.27)	0.102
30 days	-10.70 (-18.14, -3.26)	0.005	-8.93 (-15.65, -2.20)	0.010	-6.13 (-10.89, -1.36)	0.012
60 days	-23.96 (-32.41, -15.44)	< 0.001	-22.30 (-29.21, -15.40)	<0.001	-15.25 (-22.43, -8.00)	<0.001

Table 4

Mean PCL-5, IES-R, and BDI-II Sum Score Differences within the Control and TM Groups. p -values are Bonferroni-corrected

Time	PCL-5		IES-R		BDI-II	
	Δ (95% CI)	p	Δ (95% CI)	p	Δ (95% CI)	p
Control						
0-30 days	-0.70 (-7.95, 6.55)	1.00	-0.08 (-6.60, 6.65)	1.00	1.88 (-2.88, 6.63)	1.00
30-60 days	4.78 (-2.92, 12.47)	0.398	5.93 (-0.76, 12.61)	0.099	6.23 (0.51, 11.94)	0.028
0-60 days	4.08 (-4.74, 12.89)	0.785	5.85 (-1.54, 13.28)	0.169	8.10 (1.15, 15.05)	0.017
TM						
0-30 days	-18.53 (-25.77, -11.28)	<0.001	-16.13 (-22.65, -9.60)	<0.001	-7.55 (-12.30, -2.80)	<0.001
30-60 days	-8.45 (-16.14, -0.76)	0.026	-7.45 (-14.13, -0.77)	.024	-2.88 (-8.59, 2.84)	0.667
0-60 days	-26.98 (-35.79, -18.16)	<0.001	-23.58 (-30.96, -16.19)	<0.001	-10.43 (-17.38, -3.47)	<0.001

On mean PCL-5 sum scores, the control and TM groups differed significantly after 30 days (Welch's $F[1, 50.53] = 8.20, p = 0.006$), and after 60 days (Welch's $F[1, 44.42] = 31.49, p < 0.001$). At both post-tests, the TM group reported less PTSD symptoms than the control group [$\Delta s = -10.70$ [95% CI -18.14 to -3.26] and -23.96 [95% CI -32.41 to -15.44], Bonferroni-corrected $ps = 0.005$ and < 0.001].

Kruskal-Wallis tests confirmed these results ($\chi^2s[1] = 4.09$ and $26.72, ps = 0.043$ and < 0.001). Within the control group, reported PTSD symptom severity did not significantly change over time ($F[2, 78] = 0.83, p = 0.439$, partial $\eta^2 = 0.02$). Within the TM group, there were significant changes (Greenhouse-Geisser $F[2, 55.95] = 74.60, p < 0.001$, partial $\eta^2 = 0.66$), less PTSD symptoms were reported at both post-tests ($\Delta s = -18.53$ [95% CI -25.77 to -11.28] and -8.45 [95% CI -16.14 to -0.76], Bonferroni-corrected $ps < 0.001$ and $= 0.026$). This pattern of results was confirmed by Friedman tests for both the control group ($\chi^2[2] = 0.17, p = 0.920$) and the TM group ($\chi^2[2] = 52.55, p < 0.001$).

On mean IES-R sum scores, the control and TM groups differed significantly at baseline (Welch's $F[1, 77.96] = 4.87, p = 0.030$), after 30 days [Welch's $F[1, 65.14] = 6.97, p = 0.010$], and after 60 days (Welch's $F[1, 53.34] = 41.34, p < 0.001$). Compared to the control group, the TM group reported more PTSD symptoms at the beginning ($\Delta = 7.13$ [95% CI .70 to 13.55], $p = 0.030$) but less PTSD symptoms at the post-tests ($\Delta s = -8.93$ [95% CI -15.65 to -2.20] and -22.30 [95% CI -29.21 to -15.40], Bonferroni-corrected $ps = 0.010$ and < 0.001). Kruskal-Wallis tests showed significant differences only at baseline ($\chi^2[1] = 5.10, p = 0.024$) and after 60 days [$\chi^2[1] = 24.68, p < 0.001$]. Within the control group, reported PTSD symptoms did not change with time ($F[2, 78] = 2.07, p = 0.133$, partial $\eta^2 = 0.05$). Within the TM group, reported PTSD symptom severity changed significantly over time ($F[2, 78] = 62.96, < 0.001$,

partial $\eta^2 = .62$) and was lower at both post-tests ($\Delta s = -16.13$ [95% CI -22.65 to -9.60] and -7.45 [95% CI -14.13 to -0.77], Bonferroni-corrected $ps < 0.001$ and $= 0.024$). Friedman tests confirmed these results for both the control group ($\chi^2[2] = 0.96, p = 0.618$) and the TM group ($\chi^2[2] = 50.92, p < 0.001$).

On mean BDI-II sum scores, the control and TM groups differed significantly after 30 days (Welch's $F[1, 47.67] = 6.55, p = 0.014$) and after 60 days (Welch's $F[1, 40.99] = 17.59, p < 0.001$). The TM group reported less depression symptoms than the control group at both post-tests ($\Delta s = -6.13$ [95% CI -10.89 to -1.36] and -15.23 [95% CI -22.45 to -8.00], Bonferroni-corrected $ps = 0.012$ and < 0.001). Kruskal-Wallis tests showed significant differences only after 60 days ($\chi^2[1] = 7.06, p = 0.008$). Within the control group, there was a significant effect of the time factor on reported depression symptom severity (Greenhouse-Geisser $F[2, 63.09] = 3.66, p = 0.040$, partial $\eta^2 = 0.09$), reported symptoms increased between the 30 and 60 days post-tests ($\Delta = 6.23$ [95% CI .51 to 11.94], Bonferroni-adjusted $p = 0.028$). Within the TM group, reported depression symptom severity significantly changed over time (Greenhouse-Geisser $F[2, 49.54] = 34.00, p < 0.001$, partial $\eta^2 = 0.47$), less depression symptoms were reported after 30 days ($\Delta = -7.55$ [95% CI -12.30 to -2.80], Bonferroni-corrected $p < .001$). Friedman tests yielded similar results for both the control group ($\chi^2[2] = 0.73, p = 0.696$) and the TM group ($\chi^2[2] = 42.53, p < 0.001$).

Effects of the TM program on self-reported PTSD and depression symptom change

Table 5 contains the means and standard deviations of the PCL-5, IES-R, and BDI-II change scores. Mixed ANOVA models showed a highly significant effect of the group factor on all outcomes: PCL-5 ($F[1, 78] = 37.11, p < 0.001$, partial $\eta^2 = 0.32$), IES-R ($F[1, 78] = 47.50, p < 0.001$, partial $\eta^2 = 0.38$), BDI-II ($F[1, 78] = 21.26, p < 0.001$, partial $\eta^2 = 0.21$).

Table 5

Means and Standard Deviations of PCL-5, IES-R, and BDI-II Change Scores. Control Group n = 40, TM Group n = 40, Total Sample N = 80

Time Interval	Condition	PCL-5		IES-R		BDI-II	
		M	SD	M	SD	M	SD
Baseline – 30 days	Control	-0.70	21.33	-0.06	19.12	1.86	14.70
	TM	-18.54	15.70	-16.12	14.23	-7.55	9.26
	Total	-9.61	20.69	-8.10	18.59	-2.84	13.10
30 days – 60 days	Control	4.78	26.69	5.92	21.44	6.23	20.48
	TM	-8.45	8.84	-7.45	11.70	-2.88	4.16
	Total	-1.84	20.85	-0.76	18.44	1.68	15.38

There was a significant effect of the time factor on PCL-5 ($F[1, 78] = 4.97, p = 0.029$, partial $\eta^2 = 0.06$) and IES-R change scores ($F[1, 78] = 5.38, p = 0.023$, partial $\eta^2 = 0.07$), but it barely missed significance with

BDI-II change scores ($F[1, 78] = 3.92, p = 0.051$, partial $\eta^2 = 0.05$). Figures 4, 5, and 6 depict the identified pattern of results for the PCL-5, IES-R, and BDI-II change scores, respectively.

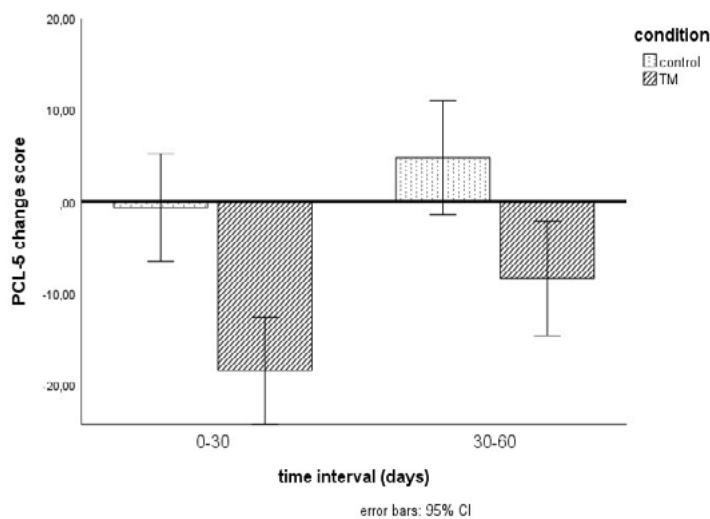


Figure 4. PTSD symptom change, assessed with the PCL-5 scale, by treatment group: Comparison of the TM and control groups on mean PCL-5 change scores for the 0-30 days and 30-60 days intervals.

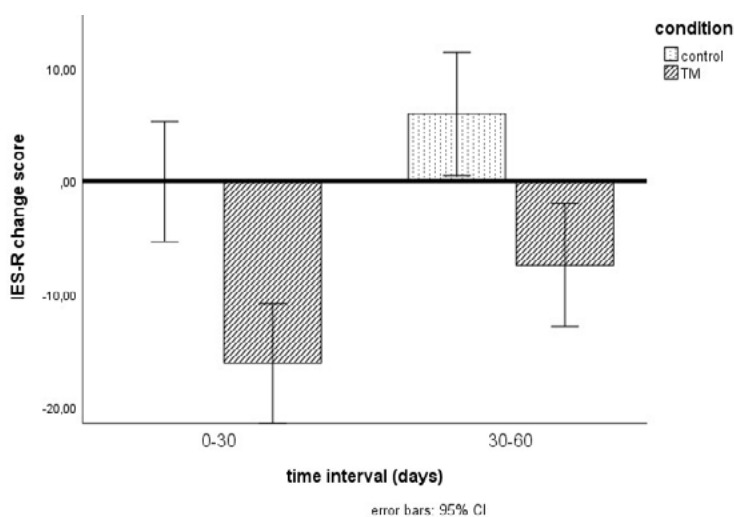


Figure 5. PTSD symptom change, assessed with the IES-R scale, by treatment group: Comparison of the TM and control groups on mean IES-R change scores for the 0-30 days and 30-60 days intervals.

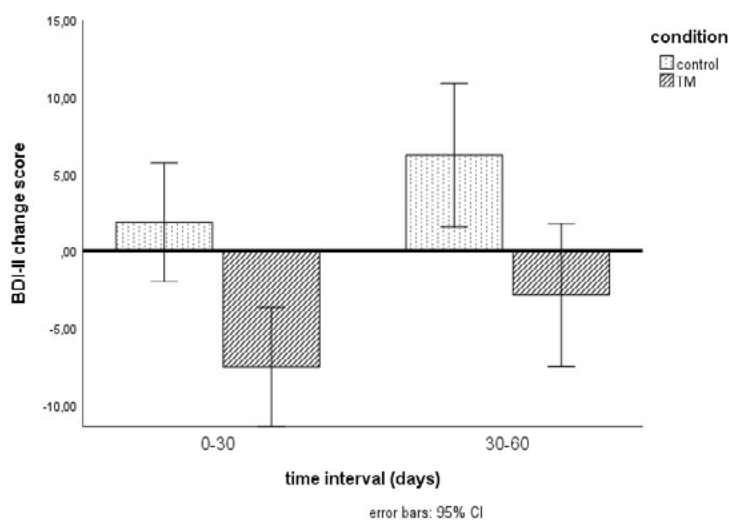


Figure 6. Depression symptom change, assessed with the BDI-II scale, by treatment group: Comparison of the TM and control groups on mean BDI-II change scores for the 0-30 days and 30-60 days intervals.

Again, the requirement of variance homogeneity was not consistently met: PCL-5 ($F_s[1, 78] = 3.03$ and 23.69 , $ps = 0.086$ and $< .001$), IES-R ($F_s[1, 78] = 2.45$ and 10.74 , $ps = 0.121$ and 0.002), BDI-II ($F_s[1, 78] = 6.52$ and 32.50 , $ps = 0.013$ and < 0.001), so follow-up

analyses were conducted using robust and non-parametric procedures.

Tables 6 and 7 display the differences in mean change scores between the control and TM groups, and within each group.

Table 6

Mean PCL-5, IES-R, and BDI-II Change Score Differences Between the Control and TM Groups. p-values are Bonferroni-corrected

Time	PCL-5		IES-R		BDI-II	
	Δ (95% CI)	p	Δ (95% CI)	p	Δ (95% CI)	p
0-30 days	-17.83 (-26.16, -9.49)	<0.001	-16.05 (-23.55, -8.55)	<0.001	-9.23 (-14.89, -3.96)	<0.001
30-60 days	-13.23 (-22.08, -4.37)	0.004	-13.38 (-21.07, -5.68)	<0.001	-9.10 (-15.68, -2.52)	0.007

Table 7

Mean PCL-5, IES-R, and BDI-II Change Score Differences Within the Control and TM Groups. p-values are Bonferroni-corrected

Time	PCL-5		IES-R		BDI-II	
	Δ (95% CI)	p	Δ (95% CI)	p	Δ (95% CI)	p
Control	5.46 (-4.34, 15.29)	0.270	6.00 (-2.91, 14.91)	0.184	4.35 (-2.07, 10.77)	0.181
TM	10.06 (0.26, 19.89)	0.004	8.68 (-0.23, 17.58)	0.056	4.68 (-1.72, 11.09)	0.151

On mean PCL-5 change scores, the control and TM groups differed significantly within the 0-30 days interval (Welch's $F[1, 71.68] = 18.12$, $p < 0.001$) and 30-60 days interval (Welch's $F[1, 47.46] = 8.85$, $p = 0.005$). For both time intervals, the TM group reported a greater amount of PTSD symptom change than the control group ($\Delta_s = -17.83$ [95% CI -26.16 to -9.49] and -13.23 [95% CI -22.08 to -4.37], Bonferroni-corrected $ps < 0.001$ and $= 0.004$). Kruskal-Wallis tests confirmed these results for both time intervals ($\chi^2_s[1] = 15.92$ and 9.08 , $ps < 0.001$ and $= 0.003$). Within the control group, there was no difference in PTSD symptom change with time ($F[1, 39] = 0.76$, $p = 0.389$, partial $\eta^2 = 0.02$). Within the TM group, reported change of PTSD symptoms differed in both time intervals ($F[1, 39] = 11.22$, $p = 0.002$, partial $\eta^2 = 0.22$), reported symptom reduction was more pronounced during the initial 30 days ($\Delta = 10.08$ [95% CI .26 to 19.89], Bonferroni-corrected $p = 0.44$). These results were confirmed by Friedman tests for both the control group ($\chi^2[1] = 1.68$, $p = 0.194$) and the TM group ($\chi^2[1] = 10.57$, $p < 0.001$).

On mean IES-R change scores, the control and TM groups differed significantly within the 0-30 days interval (Welch's $F[1, 72.06] = 18.12$, $p < 0.001$) and 30-60 days interval (Welch's $F[1, 60.33] = 11.99$, $p < 0.001$). The TM group reported a greater amount of PTSD symptom change than the control group for both time intervals ($\Delta_s = -16.05$ [95% CI -23.55 to -8.55] and -13.38 [95% CI -21.07 to -5.68], Bonferroni-corrected $ps < 0.001$). Kruskal-Wallis tests yielded similar results ($\chi^2_s[1] = 13.28$ and 9.26 , $ps < .001$ and $= 0.002$). Within the control

group, there was no difference in reported PTSD symptom change ($F[1, 39] = 1.27$, $p = 0.267$, partial $\eta^2 = 0.03$). Within the TM group, there was a significant difference ($F[1, 39] = 6.47$, $p = 0.015$, partial $\eta^2 = 0.13$), reported symptom reduction was greater within the initial 30 days ($\Delta = 8.68$ [95% CI -.23 to 17.58]), but this difference barely failed significance in the pairwise comparisons (Bonferroni-adjusted $p = 0.056$). Friedman tests showed similar results for both the control group ($\chi^2[1] = .40$, $p = 0.527$) and the TM group ($\chi^2[1] = 4.90$, $p = 0.027$).

On mean BDI-II change scores, the control and TM groups differed significantly within the 0-30 days interval (Welch's $F[1, 65.72] = 11.77$, $p < 0.001$) and 30-60 days interval (Welch's $F[1, 42.22] = 7.59$, $p = 0.009$). The TM group displayed greater change in depression symptoms during both time intervals ($\Delta_s = -9.43$ [95% CI -14.89 to -3.96] and -9.10 [95% CI -15.68 to -2.52], Bonferroni-corrected $ps < 0.001$ and $= 0.004$). Kruskal-Wallis tests confirmed these results for both time intervals ($\chi^2_s[1] = 8.07$ and 4.85 , $ps = 0.004$ and 0.028). Within the control group, changes in reported depression symptoms did not significantly differ ($F[1, 39] = 1.04$, $p = 0.314$, partial $\eta^2 = 0.03$). Within the TM group, reported symptom changes differed significantly ($F[1, 39] = 8.37$, $p = 0.006$, partial $\eta^2 = 0.18$), the reduction of symptoms slowed down after the initial 30 days ($\Delta = 4.68$ [95% CI -1.74 to 11.09]) but this effect failed to reach significance in the pairwise comparisons (Bonferroni-adjusted $p = 0.151$). Friedman tests yielded similar results for both the control group ($\chi^2[1] = 2.08$, $p = 0.150$) and the TM group ($\chi^2[1] = 11.31$, $p < 0.001$).

Effects of the TM program on the prevalence of probable PTSD

Table 8 shows the prevalence of probable PTSD, measured with the PCL-5 scale and using a cutoff score of 31, for both the control and TM groups at baseline, at 30 days, and at 60 days.

Within the control group, PTSD prevalence did not change significantly during the course of the study

($z = 0.83$, $p = 0.405$). Within the TM group, PTSD prevalence dropped significantly after 30 days ($z = -4.80$, $p < 0.001$). After 60 days, no subject in the TM group scored above the cutoff anymore. While at baseline, PTSD prevalence was significantly lower in the control group ($z = 2.47$, $p = 0.014$), after 30 days and after 60 days, the TM group featured significantly less probable PTSD ($z_s = -2.92$ and -3.94 , $p_s = 0.003$ and < 0.001).

Table 8

Prevalence of Probable PTSD in the Control and TM Groups, Measured with the PCL-5 scale and Using a Cutoff of 31

Condition	Baseline	30 Days	60 Days
Control Group (n = 40)			
PTSD (n)	32.5% (13)	25.0% (10)	32.5% (13)
no PTSD (n)	67.5% (27)	75.0% (30)	67.5% (27)
TM Group (n = 40)			
PTSD (n)	60.0% (24)	2.5% (1)	– (0)
no PTSD (n)	40.0% (16)	97.5% (39)	100.0% (40)

DISCUSSION

The results suggest that refugees who regularly practiced the TM program experienced a significant reduction of PTSD and depression symptoms within two months after taking up the practice.

The decrease in reported symptom severity was highly significant at the 30-day post-test, and remained significant at the 60-day post-test for PTSD but not for depression; however depression symptoms continued to decrease. The latter finding may be explained by the fact that at baseline, subjects in the TM group on average reported substantial symptoms of PTSD but only mild symptoms of depression, so that a significant reduction of symptoms could be expected only for PTSD. The decrease in reported symptoms of both PTSD and depression was significantly stronger during the initial 30 days after starting the TM practice, suggesting that TM is a rapid-acting treatment. Moreover, the TM program also seems to be highly effective in improving the condition of PTSD, as the rate of subjects who scored above the PCL-5 cutoff of 31, indicating probable PTSD, dropped from 60% at the baseline test to 2.5% at the 30-day post-test, and to 0% at the 60-day post-test.

Previous research indicated that the practice of TM significantly reduced symptoms of depression at a 3-month and 4-month post-test, respectively [14, 24]. The results of the current study are in line with these findings; however since the design included two post-tests at 30 days and 60 days, it could be shown that the effects of the TM program set in quickly, as the most substantial reduction of reported symptoms occurred within 30 days after taking up TM practice already. Studies also showed that the TM program significantly alleviated posttraumatic stress across various samples, with post-test intervals ranging from 10 days up to 6 months [2, 4, 5, 7, 15, 18, 23, 25, 26, 29, 30, 32, 36]. The current results confirm these findings, and in line with studies featuring more

than one post-test, it was found that the effects of the TM program set in quickly and the strongest reduction of reported symptoms was measured at the first post-test. As in previous studies, subject compliance with TM practice was high, and no adverse effects were reported.

The findings furthermore imply that the differences in reported symptom severity between the TM and control groups at the 30 and 60-day post-tests can be ascribed to the effect of the TM program. After 30 days, subjects in the TM group experienced significantly less symptoms of both PTSD and depression in comparison to the control group, although the control group had reported slightly, albeit mostly non-significantly stronger symptoms initially. After 60 days, the differences between the two groups were highly significant, as subjects in the TM group experienced very little symptoms, whereas the control group remained mostly unchanged.

A surprising finding was the increase in depression symptoms in the control group. An explanation might be that the refugees increasingly suffered from the ongoing war in Ukraine and the fact that they were away from their home country which they would not have intended to leave otherwise. All three hypotheses were confirmed with regard to PTSD, but depression symptom reduction in the TM group within the 30 to 60-day interval failed to reach significance.

Study Limitations

Internal Validity. The validity of the results may be impaired by the rather small sample size. Although the potentially confounding variable of time, such that the passing of time alone might have an effect on experienced symptom severity independent of the TM practice, was controlled for by the sampling of a control group, unfortunately the control group did not match the TM group in distribution of sex and prevalence of probable PTSD at baseline measurement. On all outcome measures, the control group scored slightly higher initially. However,

these differences were significant only with the IES-R scale. This may have to do with the fact that under the given circumstances, it was not possible to perfectly randomize the distribution of subjects to the conditions, so that individuals who experienced stronger symptoms may have been more likely to start the TM program.

The findings might further be affected by the fact that subjects were accepted to the study without a criterion for minimum symptom severity at baseline; however, the inclusion of subjects with low experience of symptoms would rather have resulted in underestimating the effect of the TM program. The effects that are significant or even highly significant thus contribute to the notion that the TM program is effective in symptom reduction.

A probable confounding variable not controlled for was the housing situation of subjects, or changes in housing situation during their participation in the study. Some lived in the local refugee hostels, whereas others had found accommodation in the private homes of German residents. However, this effect may have been prevalent in both groups and therefore less likely to influence the findings.

Although neither the control group nor the TM group received psychological treatment, there may have been a stabilizing effect of the group and one-on-one check-up meetings which were scheduled every week or two weeks for subjects in the TM group only. Since subjects in the control group did not learn the TM program, there was no need for such weekly meetings. The attendance of the check-up meetings alone may have evoked a notion of being taken care of and thus positively affected subjects who learned the TM program. This probable confounding cannot be ruled out.

Finally, the fact that there was a kind of intervention at all for subjects in the TM group, whereas the control group did not receive any intervention, may have had a favourable effect on subjects in the TM group due to positive expectations. This possibility cannot be ruled out either.

External Validity. The generalization of the findings is limited by the small sample size. Further research is needed to determine whether the findings can be replicated with a larger sample of Ukrainian refugees in Germany, with Ukrainian refugees in other countries, or with refugees of different nationality and cultural background.

CONCLUSIONS

The quick and effective treatment of PTSD and depression is an urgent issue for the countries that have received Ukrainian refugees, as well as for Ukraine itself, given the large number of Ukrainians displaced by the war and the ongoing acts of war in Ukraine which will probably lead to an additional flow of refugees. Another concern is the provision of treatment to a vast number of people within a short amount of time.

Altogether, the findings suggest that regular practice of the TM program is effective to significantly reduce both PTSD and depression symptoms within as little as 30 days, and may even lead to a recovery from the clinical condition after a period of two months, without any additional psychological treatment. The conduct of future studies is therefore warranted to determine whether the TM program may serve as a viable addition or even an alternative to existing treatment options, how it proves successful with other mental health conditions and psychological wellbeing, and how stable the effects of the TM practice turn out to be over time.

Perspectives for further research. Further studies should be conducted in larger samples of Ukrainian refugees in order to confirm the reproducibility and robustness of the observed effects of the Transcendental Meditation program on symptoms of posttraumatic stress disorder and depression. It is also advisable to use more methodologically balanced group allocation procedures to minimize baseline differences between comparison groups. Future research should include longer follow-up periods to assess the stability of the therapeutic effects over time and should examine the influence of potentially confounding factors, including housing conditions, the intensity of additional interpersonal support during follow-up, and baseline symptom severity. It would also be appropriate to evaluate the applicability of this approach in Ukrainian refugees residing in other host countries, as well as in other trauma-exposed populations with different sociocultural backgrounds.

COMPLIANCE WITH ETHICAL REQUIREMENTS

The study was approved by the Ethical Approval Commission at Bogomolets National Medical University, Kyiv, Ukraine. The trial was conducted in Lübeck, Northern Germany, from May to September 2022 and involved a non-invasive intervention. Participation in the study was voluntary. Before enrollment, participants received information about the study procedures and the Transcendental Meditation program and independently decided whether to take part in the study.

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The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

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Резюме

РЕДУКЦІЯ ПРОЯВІВ ПОСТТРАВМАТИЧНОГО СТРЕСОВОГО РОЗЛАДУ ТА ДЕПРЕСІЇ У УКРАЇНСЬКИХ БІЖЕНЦІВ, ЯКІ ПРАКТИКУЮТЬ ТРАНСЦЕНДЕНТАЛЬНУ МЕДИТАЦІЮ

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Вступ. Після повномасштабного вторгнення Росії в Україну суттєво зросла потреба в доступних, швидкодіючих і немедикаментозних підходах до корекції симптомів посттравматичного стресового розладу та депресії в українських біженців. Одним із таких потенційних підходів є програма трансцендентальної медитації.

Мета. Оцінити ефективність програми трансцендентальної медитації щодо зменшення симптомів посттравматичного стресового розладу та депресії в українських біженців, які перебували в Німеччині.

Матеріали та методи. У дослідження включено 80 українських біженців: 40 осіб основної групи, які практикували трансцендентальну медитацію протягом 60 днів, і 40 осіб контрольної групи без такої практики. Вираженість симптомів посттравматичного стресового розладу оцінювали за шкалами PCL-5 та IES-R, симптомів депресії – за шкалою BDI-II на початку дослідження, через 30 і 60 днів. Для аналізу результатів застосовано параметричні та непараметричні статистичні методи.

Результати. Уже через 30 днів в основній групі встановлено статистично значуще зниження симптомів посттравматичного стресового розладу та депресії порівняно з вихідним рівнем. Частка осіб із імовірним посттравматичним стресовим розладом зменшилася з 60,0% до 2,5%, а через 60 днів у цій групі не залишилося жодного учасника з показниками вище діагностичного порога. На 30-й і 60-й день основна група мала статистично значуще кращі показники за шкалами PCL-5, IES-R та BDI-II порівняно з контрольною групою. У контрольній групі істотного зменшення симптомів посттравматичного стресового розладу не виявлено, тоді як наприкінці спостереження симптоми депресії мали тенденцію до посилення.

Висновки. Регулярна практика трансцендентальної медитації асоціюється зі швидким і статистично значущим зменшенням симптомів посттравматичного стресового розладу та депресії в українських біженців. Програма може розглядатися як перспективний допоміжний або альтернативний немедикаментозний підхід у системі психосоціальної підтримки, однак потребує подальшого вивчення на більших вибірках.

Ключові слова: посттравматичний стресовий розлад, депресія, українські біженці, трансцендентальна медитація, психосоціальна підтримка

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