

Comparison of face-to-face and synchronous online mindfulness-based interventions: a quasi-experimental study

BACKGROUND

Mindfulness-based interventions (MBIs) are a widely validated approach for the treatment and prevention of various pathologies, leading to increased physical and psychological health. Online MBIs have become more common in the past years, namely after the COVID-19 pandemic, but not much is known about their effectiveness. This study's goal was to compare the efficacy of a face-to-face MBI with its online equivalent.

PARTICIPANTS AND PROCEDURE

A total of 114 university students of multiple nationalities participated in the investigation. This is a quasi-experimental study, with pre-, post-, and 3-month follow-up comparative measurements in two types of group formats: in-person groups and synchronous online groups.

RESULTS

The results showed benefits for participants in both the face-to-face and online interventions. Anxiety was significantly reduced at post-test, while stress, depression, and emotion regulation difficulties were significantly reduced

at post-test and at follow-up. Furthermore, well-being and optimism were significantly increased at post-test and at follow-up. Between-group comparisons indicated higher efficacy for these variables in the online group.

CONCLUSIONS

The fact that differential outcomes were observable for mindfulness and one of the expected mechanisms, in goal-directed thinking, while no significant differences were present for any outcome, shines a light on possible hidden mechanisms that differentiate how online interventions function when compared to their face-to-face counterparts. Despite these differences, the findings support the viability of online mindfulness interventions as an alternative to in-person formats. The present study adds to current knowledge about mindfulness interventions by supporting the feasibility of online mindfulness interventions.

KEY WORDS

anxiety; depression; emotion regulation; mindfulness-based intervention; online intervention; stress

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TO CITE THIS ARTICLE – Jesus, S., Antunes, J. P., Andretta, I., Russel, T., Mello, L., & Chiodelli, R. (2025). Comparison of face-to-face and synchronous online mindfulness-based interventions: a quasi-experimental study. *Health Psychology Report*, 13(4), 354–365. <https://doi.org/10.5114/hpr/208641>

RECEIVED 22.04.2025 · REVIEWED 17.07.2025 · ACCEPTED 25.07.2025 · ONLINE PUBLICATION 08.10.2025



BACKGROUND

Mindfulness-based interventions (MBIs) represent an emerging and effective treatment approach for a variety of psychological and physical conditions, functioning through multiple mechanisms such as enhanced emotional regulation and a deepened awareness of the present moment (Roemer et al., 2015). Over the past few decades, MBIs have gained substantial empirical support, establishing themselves as a widely validated and evidence-based approach to improving mental health and overall well-being (e.g., O'Driscoll et al., 2017). In particular, within the field of anxiety and depression, MBIs have demonstrated superior efficacy compared to non-evidence-based interventions and have shown comparable effectiveness to established treatments such as cognitive-behavioural therapy (CBT) (Hoffman & Gómez, 2017). One of the defining features of MBIs is their emphasis on fostering positive psychological states rather than solely targeting symptom reduction. By cultivating well-being, self-compassion, and positive affect, MBIs promote a holistic approach to mental health that aligns with contemporary positive psychology principles (Creswell, 2017; Shapiro et al., 2008). This perspective supports individuals not only in a certain moment or context, but throughout their lifetime. As a practical example, Fabio and Tripodi (2024) found evidence of a “poor-get-poorer” model of self-esteem, well-being, and mental health, finding that those who struggled most with these facets of life were more likely to engage in behaviours that were counterproductive to building self-esteem and well-being. By providing individuals with mindfulness tools, they can learn how to disengage with these positive feedback loops that lead to poorer mental health.

Mindfulness can be defined as an attitude of openness and acceptance towards one's present experience, emphasizing a non-judgmental awareness of the here and now (Quaglia et al., 2015). This form of conscious awareness contrasts with other mental states, such as mind wandering, operating on automatic pilot, or actively suppressing unwanted thoughts and emotions (Kang et al., 2013). Originally developed in the late 1970s by Jon Kabat-Zinn (2003), MBIs have grown increasingly prominent in both clinical and non-clinical settings due to their demonstrated effectiveness across a broad spectrum of human functioning. Research has shown that MBIs can lead to significant improvements in physical health (e.g. Dutt et al., 2019), cognitive performance (e.g. Charness et al., 2024), emotional regulation (e.g. Alhawatmeh et al., 2022), and interpersonal relationships (Creswell, 2017). A standard MBI programme typically follows a structured format, consisting of eight weekly sessions, each lasting approximately 2.5 hours. During these sessions, participants engage

in various mindfulness exercises – such as body-scan meditation, mindful breathing, and gentle movement – designed to cultivate sustained attention and present-moment awareness. Additionally, each meeting focuses on a specific theme that aligns with the core principles of mindfulness, including foundational attitudes such as kindness, acceptance, and patience with the mind's natural tendencies (Kabat-Zinn, 2003).

One recent trend in the field of psychological interventions has been the growing popularity of online interventions, accelerated by the COVID-19 pandemic (Chadi et al., 2020). Online mindfulness interventions have shown significant effectiveness in reducing symptoms such as depression and stress, while showing a small, but significant, effect of increased well-being (Sommers-Spijkerman et al., 2021) and increased optimism (Heckenberg et al., 2019). Overall findings for online mindfulness interventions are very promising (Sevilla-Llewellyn-Jones et al., 2018), but information is still lacking as to whether these interventions are effective when compared to other, more established, evidence-based approaches.

Recent studies have detected relevant gains for online MBI participants. Sommers-Spijkerman et al. (2021) ran a meta-analysis of online MBIs, finding medium effect sizes for depression and stress reduction, and low effect size reductions for anxiety. Subgroup analysis demonstrated that in stress and mindfulness, significantly larger effect sizes were found for online MBIs with therapist guidance when compared to online MBIs without therapist guidance (Sommers-Spijkerman et al., 2021). These outcomes support the hypothesis that having a direct contact with the facilitator increases chances of better effects. When comparing online to non-online MBIs in their ability to improve well-being, the latter show higher variability, ranging from small to large effect sizes (Zhang et al., 2021), possibly due to the lower number of studies conducted, in comparison to face-to-face modalities. Such findings raise concerns about the viability of online MBI to increase positive states, when comparing them to traditional face-to-face formats.

Face-to-face interventions tend to offer a more natural interaction between participants and facilitators. Additionally, dynamics with bodily movements tend to be more difficult to accomplish by video conferencing. However, synchronous online interventions have some advantages over face-to-face interventions: (1) time saved in transportation; (2) reduced expenses; (3) ease of accessibility (Sommers-Spijkerman et al., 2021). Therefore, one must weigh the advantages of this medium against its shortcomings.

In the field of cognitive-behavioural therapy (CBT), various non-inferiority trials have shown that online CBT can show similar effectiveness when compared to face-to-face CBT in reducing depression and anxiety (Andersson et al., 2013; Hedman et al.,

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2011), supporting online interventions' viability. To date, no such trials comparing modalities have been carried out in the field of MBIs.

The Interculturality and Mindfulness Program (PIM) is a mindfulness-based intervention aimed at displaced university students. Its fundamental principle is to establish, through mindfulness, a welcoming and trusting atmosphere, to reduce participants acculturative stress and develop group cohesion. The intervention was implemented both in-person and online, and has been shown to effectively reduce stress, anxiety, depression, and emotion deregulation, while increasing well-being and optimism (Chiodelli et al., 2022).

Based on the scarce knowledge about MBI vs. e-MBI effectiveness, as well as the increasing use of telehealth, this study aims to compare the expected outcomes of the same mindfulness-based programme between face-to-face and synchronous online formats. We intend to examine the effects of the PIM intervention on depression, anxiety, stress, well-being, difficulties in emotion regulation, and optimism. The following hypotheses were put forward:

- Both intervention formats will increase well-being and optimism, while reducing depression, anxiety, stress and emotion regulation difficulties.
- The intervention format will have no effect on intervention effectiveness.

PARTICIPANTS AND PROCEDURE

DESIGN

This study used a quasi-experimental design, with pre-, post-, and 3-month follow-up comparative measurements in two groups: in-person (IG) and online (OG). The study was approved by the Scientific Commission of the Faculty of Human and Social Sciences, University of Algarve, Portugal, with the reference number EDOC/2018/19967.

All procedures were performed in accordance with the General Data Protection Regulation (European Parliament and Council of the European Union, 2016), ensuring that all participants gave informed consent prior to their participation and that all data were de-identified and no information that was unnecessary to the study's purposes was collected. Informed consent was obtained through a form that contained all pertinent information about the study, possible risks, and a clear statement showing that their participation was optional and could be withdrawn at any point. Given the longitudinal nature of the study, participants were asked to generate a code based on personal information that the researchers had no access to (for example, the last four digits of their ID card). Once pairing of the data was completed (after T3), this code was deleted from the database.

Participants who agreed to participate were invited to attend an online meeting (the meeting was also online for those in the in-person format) where the facilitator would walk participants through the content of the intervention and possible setbacks (a minority of participants can feel negative reactions, such as heightened anxiety, particularly during their first attempts at the exercises), reiterating that participation is optional and ensuring them that the facilitator would be willing to help participants who struggled during and after each session.

PARTICIPANTS

After obtaining informed consent from participants, 114 students from the University of Algarve ($M_{\text{age}} = 25.4$, $SD = 7.1$) took part in the interventions. Among those who completed both pre- and post-tests, 70 (74.3% self-identified as women) were in the IG, and 44 (90.9% self-identified as women) were in the OG; all of the participants self-identified as a man or woman. Detailed sociodemographic information for the current sample is provided in Table 1. Inclusion criteria required participants to attend a minimum of four intervention sessions (66.6% attendance). Out of the initial 114 participants, only 82 completed the follow-up questionnaire.

There were no differences between groups regarding age ($p = .121$) or education level ($\chi^2 = .11$), although there were differences in gender ($p = .017$, $d = -.43$) and nationality ($p < .001$, $d = -1.12$).

INTERVENTION

The Interculturality and Mindfulness Program (PIM) was designed and led by the primary authors of this study, who had prior training in mindfulness-based cognitive therapy (MBCT), along with additional preparation specific to this action-research's MBI programme. PIM includes six weekly meetings, each lasting two hours (see Table 2). Participants received post-session activity summaries and guided meditation audio via email or text. Between sessions, participants were also sent motivational messages to encourage their weekly mindfulness practices.

Interculturality activities and content are based on the works of Sam and Berry (2016), Deardorff et al. (2012), and Sebben (2013). Most activities are adapted from intercultural competence programmes and psychodrama games. The mindfulness component of the programme is based on the book *Mindfulness: How to find peace in a frantic world* (Williams & Penman, 2015). Physical practices were typically performed before formal mindfulness exercises. These exercises are derived from the movement routines in the Body

Table 1*General sample characterization*

Variables	Total (N = 114)		In-person (IG) (n = 70)		Online (OG) (n = 44)	
	n	%	n	%	n	%
Self-identified gender						
Man	22	19.3	18	25.7	4	9.1
Woman	92	80.7	52	74.3	40	90.9
Age	25.4 ± 7.1		26.3 ± 7.7		24.1 ± 6.2	
Nationality						
Brazilian	63	55.3	52	74.3	11	25.0
Portuguese	51	44.7	18	25.7	33	75.0
Education						
Undergraduate	78	68.4	48	68.5	30	68.1
Master	24	21.0	13	18.5	11	25.0
Doctorate	12	10.5	9	12.8	3	6.8

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Table 2*Interculturality and Mindfulness Program (PIM) overview*

Sessions	Activities
0) Programme Presentation	Welcoming; “Ice-breaker”: ball game; Programme presentation; Mindfulness practice
1) Introduction and group integration “Land in sight: welcome to the University environment!”/ <i>Being present</i>	Facilitators and programme introduction; “Ice-breakers”: planning seats and rotatory interviews; “Culture Shock” activity; Mindfulness presentation and body scan
2) Positive Intercultural Attitude I “Anchorage”/ <i>Mindfulness in the daily routine</i>	“Sharing”; “Warm-up”: “Rá” game; “Ice-breaker”: Three sentences activity; Difficulties and strategies to acculturation; Informal Mindfulness meditation: Mindful eating practice
3) Positive Intercultural Attitude II “(Re)Socialization”/ <i>Body and Emotions</i>	“Sharing”; “Warm-up”: Imaginary objects activity; Cultural knowledge: chocolate game; Stages of cultural adaptation; Acceptance; Emotions in the body practice
4) Intercultural Communication I “Verbal and nonverbal communication”/ <i>Self Compassion</i>	“Sharing”; “Warm-up”: 1, 2, 3 game; Behavioural differences in communication; Self-compassion; Walking Mindfully practice; Loving-Kindness Meditation
5) Intercultural Communication II “What do we have in common?”/ <i>Observing thoughts and Gratitude</i>	“Sharing”; Warm-up: “Pim game” and “Hot Potato”; “Proverb’s game”; Group bubbles; Observing thoughts; Gratitude
6) Programme Completion “Weaving the Support Network”/ <i>Week 6 is the rest of our lives</i>	“Sharing”; Warm-up: “Weaving Connections activity”; Social support network; Rhythmic Breath meditation; “Week 6 is the rest of our lives”; Final Celebration

in Mind training protocol (Russell, 2015) and the grounding exercise (bow and arch), a core practice in Bioenergetic Psychotherapy (Lowen & Lowen, 1977). Additional details about PIM were provided by Chiodelli et al. (2021).

PROCEDURES

All students were invited to join via the university’s institutional email, posters, and social media channels. Two weeks before the first session, facilitators

conducted a PIM presentation workshop (session zero). During session 1, participants were asked to read and, if they agreed, sign the free and informed consent form.

In the IG, sessions were held in a spacious classroom with a screen projector and a whiteboard, with chairs arranged in a circle. The OG was synchronous, conducted through the *Zoom* video conference platform, and sessions had the same duration as the IG (2 hours). Activities which involved more physical interactions had to be adapted for the OG; however, the activities' main purposes were not altered. As such, most ice-breakers, which involved physicality in some way, had to be changed. For example, exercises that required the participants to point at each other were changed so that instead they called out to each other by name. While in the face-to-face format participants were asked to break up into smaller groups, online participants were instead sent to sub-rooms within the videoconference, through a feature available in *Zoom*. Some exercises were also adapted due to reduced space, such as walking meditations, where participants who were unable to actually walk due to limitations of the format were instead invited to walk in place or sway side-to-side, or, as a last resort, simply stand while imagining themselves walking. Lastly, exercises that involved drawing on paper were replicated online using the whiteboard feature on *Zoom*.

Ten PIMs were held between 2022 and 2023, six in face-to-face format (IG) and four in online format (OG). 114 participants responded to the pre- and post-test questionnaire, but only 82 filled out the follow-up measures, indicating a 28.07% attrition rate. Although participants self-selected for their intervention format, within-group allocation to intervention groups occurred based on registration order. Once enough individuals accepted participation in a certain format to create a group, they were invited to join that group, and any individuals who registered afterwards would be placed on a waitlist, until another group had enough registrations to be formed.

MEASURES

Apart from the sociodemographic questionnaire, which was developed by the authors, measures were used to collect information on mindfulness, stress, anxiety, depression, emotional regulation difficulties, optimism, and well-being. Information on these is presented below.

The Philadelphia Mindfulness Scale (PHLMS) was developed by Cardaciotto et al. (2008), validated and adapted to European Portuguese by Teixeira et al. (2017). It consists of a 5-point Likert scale and 20 items, divided into two dimensions: "Acceptance"

and "Awareness." Both dimensions presented internal consistency of .85 and .77, respectively. In the present study, Cronbach's α ranged from .76 to .86 for acceptance and from .76 to .87 for awareness.

The Optimism Scale, developed for the Portuguese population by Oliveira (1998), includes four items that constitute one dimension. Answers are scored on a 5-point Likert-type scale from 1 (*totally disagree*) to 5 (*totally agree*). Its internal consistency is .80. In this study, Cronbach's α values ranged from .82 to .88.

The Satisfaction with Life Scale (SWLS), developed by Diener et al. (1985) and adapted and validated in Portugal by Silva et al. (2015), assesses the subjective judgment that each individual makes about the quality of their own life. It is a one-dimensional 5-item instrument, and the answer format is Likert-type (1 – *strongly disagree*; 5 – *strongly agree*). The authors of the Portuguese validation found an internal consistency of .78. In this study, Cronbach's α values ranged from .77 to .83.

The Difficulties in Emotion Regulation Scale (DERS) was developed by Gratz and Roemer (2004) and translated and adapted to European Portuguese by Coutinho et al. (2010). It contains 36 items on a five-point Likert scale ranging from 1 (*almost never*) to 5 (*almost always*). The scale assesses emotional deregulation in six domains, reported with their respective Cronbach alphas: "non-acceptance" – nonacceptance of emotional responses; "goals" – difficulties engaging in a goal-directed behaviour; "impulse" – impulse control difficulties, "awareness" – lack of emotional awareness; "strategies" – limited access to emotion regulation strategies; and "clarity" – lack of emotional clarity. The scale showed high values of internal consistency (.93) in Coutinho et al.'s (2010) original study. In the present study, total DERS Cronbach's α ranged from .89 to .94. Reliability values for the subscales were: non-acceptance (.86 to .91), goals (.82 to .89), impulse (.79 to .89), awareness (.81 to .86), strategies (.77 to .91), and clarity (.78 to .85).

The Depression, Anxiety and Stress Scale (DASS-21) was developed by Lovibond and Lovibond (1995) and translated and adapted to Portuguese by Apóstolo et al. (2006). DASS-21 contains a set of three Likert-type subscales, with four points ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much or most of the time*). Each subscale consists of seven items that assess the emotional states of depression, anxiety, and stress, with a maximum score of 42. Each dimension has cut-off points according to severity ratings: normal, mild, moderate, severe, and extremely severe. Cronbach's α was .92 for depression, .90 for stress, and .86 for anxiety. The analysis and distribution of factors among the subscales indicated that the structure of the three distinct factors was adequate. In this study, Cronbach's α values ranged from .82 to .93 for depression; from .70 to .89 for anxiety; and from .77 to .92 for stress.

DATA COLLECTION

The instruments were administered, through Google Forms, at the start of the first session (T1), at the conclusion of the final (sixth) session (T2), and three months following the last session (T3).

DATA ANALYSIS

Statistical treatment of the data was performed through SPSS v. 29.0.00. Given the sample disparity between T2 and T3, analyses were run for T1 and T2, followed by T1, T2 and T3, and are reported separately. Descriptive analysis was followed by mixed ANOVAs to test for differential outcomes when considering time effects and the interaction between time and group membership. Post-hoc tests were performed with the Bonferroni method to check for significant differences between groups. Since the intent of this investigation was to check for differential effectiveness, and not to assess whether the intervention was effective or not, further analysis was carried out if no interaction effect was found. For more information on the PIM's overall effectiveness, see Chiodelli et al. (2022).

In cases where Box's test showed $p \leq .05$, outliers were removed until this was no longer the case. Regarding sphericity, if the Greenhouse-Geiser value was higher than .95, sphericity was assumed, and if

.95 \geq Greenhouse-Geiser \geq .75, Greenhouse-Geiser correction was used. This value never fell below .75.

RESULTS

WITHIN- AND BETWEEN-GROUP DIFFERENCES

In order to properly contextualize any interactions found between group and time effects, Table 3 contains *t*-test results comparing group differences across each time-point for all outcome variables.

Mindful awareness was significantly higher at pre-test and follow-up in the online group, showing a medium-sized difference between groups. Stress was significantly lower in the face-to-face group, also showing a medium-sized difference. These initial results suggest that both groups generally showed the same changes over time, supporting similar efficacy for both formats. Possible causes of the differential changes related to stress are considered in the discussion section.

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PRE- AND POST-TEST INTERACTION RESULTS

Box's equality of covariance matrices test and Greenhouse-Geiser values for each variable were within acceptable values, indicating that there was no need to remove any outliers for the following ANOVA.

Table 3

Differences between in-person and online groups at each time-point for all outcome variables

Variable	Pre-test		Post-test		Follow-up	
	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>	<i>p</i>	<i>d</i>
Mindful awareness	.004	-.51	.432	-.03	.026	-.44
Mindful acceptance	.437	-.04	.321	-.09	.344	.09
DERS	.345	-.08	.454	.02	.136	.24
Non-acceptance	.470	-.01	.312	-.09	.494	-.004
Goals	.066	-.29	.460	.02	.095	.29
Impulse	.094	-.26	.421	.04	.262	.14
Awareness	.413	.04	.262	.12	.061	.35
Strategy	.463	.02	.445	-.03	.493	.00
Clarity	.236	.14	.281	.11	.063	.34
Depression	.412	.04	.490	-.01	.106	.28
Anxiety	.470	-.01	.291	.11	.065	.34
Stress	.461	-.02	.240	.14	.011	.52
Optimism	.275	.12	.330	.09	.374	.07
SWLS	.135	-.21	.273	.12	.320	-.10

Note. DERS – Difficulties in Emotion Regulation Scale; SWLS – Satisfaction with Life Scale.

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Table 4 contains descriptive statistics, along with ANOVA results, for all study variables. Despite initial results indicating that mindful awareness and satisfaction with life both had an interaction effect, therefore indicating differential outcomes dependent on group condition, mindful awareness only showed significant differences at T1 ($p = .009$), which were no longer present at T2 ($p = .863$). Additionally, post-hoc tests show no significant between-group differences either at pre-test ($p = .269$) or post-test ($p = .545$) for satisfaction with life. The results, generally, indicate no significant interaction effects between variables, suggesting no differences in outcomes between modalities.

PRE-, POST-, AND FOLLOW-UP INTERACTION RESULTS

Due to increased attrition (28%), initial differences between the participants who finished the follow-up and those who did not were tested using a t -test. No differences were found for any demographic variables, but participants who persisted until follow-up were found to have significantly higher stress levels ($t = 3.22$, $p = .002$, $d = .53$). Once again, it was necessary to verify whether sphericity and equality of variances were within acceptable ranges to ensure

the validity of the ANOVA results, which are reported in Table 5. Although Greenhouse-Geiser results show no problematic values, Box's results for strategies ($p = .013$), depression ($p = .015$), and anxiety ($p < .001$) indicated that several outliers needed to be removed. Thus, during the ANOVA for strategies, three outliers were removed, seven outliers were removed for depression, and two were removed while analysing anxiety.

Once the pre-requisites for mixed ANOVA were met, the analysis was performed, and results are reported in Table 6. For anxiety, no significant effects over time were observed once follow-up was included, while depression did show a significant time effect that was not present at post-test. Interaction effects for satisfaction with life were no longer present at follow-up. Mindful awareness and the Goals subscale of DERS both showed a significant interaction effect.

Post-hoc tests indicated that although there was an interaction effect for goal-directed thinking, there were no observable differences between groups at pre-test ($p = .148$), post-test ($p = .823$) or follow-up ($p = .190$). Similarly to previous results, there was an interaction effect on mindful awareness, but post-hoc tests showed that baseline differences were significant ($p = .009$) but not sustained at post-intervention ($p = .837$) or follow-up ($p = .052$).

Table 4

Descriptive statistics and mixed ANOVA results for all considered variables after intervention

Variable	<i>M (SD)</i>				Intervention effects	
	IG		OG		Time	Time/group interaction
	T1	T2	T1	T2		
Mindful awareness	23.3 (6.1)	26.7 (5.8)	26.5 (6.3)	26.9 (4.1)	< .001	.007
Mindful acceptance	15.4 (7.6)	19.3 (6.6)	16.6 (6.4)	20.5 (4.7)	< .001	.792
DERS	88.5 (22.8)	79.4 (23.6)	90.3 (21.3)	78.9 (19.7)	< .001	.580
Non-acceptance	14.0 (6.1)	11.5 (6.3)	14.1 (5.6)	12.1 (5.7)	< .001	.699
Goals	16.3 (4.5)	15.5 (4.5)	17.6 (4.8)	15.5 (4.1)	.001	.077
Impulse	12.6 (5.0)	11.9 (4.9)	13.9 (4.8)	11.8 (3.8)	.001	.084
Awareness	15.4 (5.1)	14.2 (5.1)	15.2 (4.7)	13.6 (4.7)	.001	.678
Strategy	18.7 (7.1)	16.0 (7.1)	18.6 (6.3)	16.2 (6.4)	.001	.803
Clarity	11.6 (4.0)	10.17 (3.1)	11.0 (4.0)	9.8 (3.2)	< .001	.772
Depression	9.3 (7.9)	7.8 (7.0)	9.0 (9.2)	7.9 (6.8)	.114	.808
Anxiety	7.9 (7.8)	6.9 (6.8)	8.0 (8.2)	6.1 (6.8)	.048	.565
Stress	16.6 (9.0)	13.3 (7.4)	16.8 (11.2)	12.3 (7.4)	< .001	.504
Optimism	16.6 (3.5)	17.3 (2.8)	16.2 (3.2)	17.1 (2.6)	< .001	.720
SWLS	17.7 (4.0)	19.4 (3.9)	18.5 (4.1)	18.9 (3.8)	< .001	.007

Note. DERS – Difficulties in Emotion Regulation Scale; SWLS – Satisfaction with Life Scale.

Table 5*Equality of variances and sphericity values for pre-, post-test and follow-up*

Variable	Equality of variances (Box)	Sphericity (Greenhouse-Geiser)	<i>Face-to-face & online MBI</i>
Mindful awareness	.481	.903	
Mindful acceptance	.337	.877	
DERS	.284	.799	
Non-accept	.657	.882	
Goals	.833	.974	
Impulse	.197	.957	
Awareness	.358	.970	
Strategy	.131	.804	
Clarity	.402	.860	
Depression	.496	.966	
Anxiety	.081	.998	
Stress	.198	.884	
Optimism	.725	.935	
SWLS	.189	.893	

Note. DERS – Difficulties in Emotion Regulation Scale; SWLS – Satisfaction with Life Scale.**Table 6***Descriptive statistics and mixed ANOVA results for all considered variables after follow-up*

Variable	<i>M (SD)</i>						Intervention effects	
	IG			OG			Time	Time/group interaction
	T1	T2	T3	T1	T2	T3		
Mindful awareness	23.3 (6.1)	26.7 (5.8)	25.9 (6.3)	26.5 (6.3)	26.9 (4.1)	28.5 (5.4)	.002	.009
Mindful acceptance	15.4 (7.6)	19.3 (6.6)	20.8 (6.9)	16.6 (6.4)	20.5 (4.7)	20.2 (6.6)	< .001	.344
DERS	88.5 (22.8)	79.4 (23.6)	75.9 (20.4)	90.3 (21.3)	78.9 (19.7)	71.5 (14.0)	< .001	.650
Non-accept	14.0 (6.1)	11.5 (6.3)	10.8 (5.0)	14.1 (5.6)	12.1 (5.7)	10.8 (4.2)	< .001	.415
Goals	16.3 (4.5)	15.5 (4.5)	14.3 (4.2)	17.6 (4.8)	15.5 (4.1)	13.2 (3.6)	< .001	.011
Impulse	12.6 (5.0)	11.9 (4.9)	11.7 (5.0)	13.9 (4.8)	11.8 (3.8)	11.0 (3.2)	< .001	.097
Awareness	15.4 (5.1)	14.2 (5.1)	14.34 (4.9)	15.2 (4.7)	13.6 (4.7)	12.8 (3.8)	.005	.863
Strategy	18.7 (7.1)	16.0 (7.1)	14.1 (5.1)	18.6 (6.3)	16.2 (6.4)	14.8 (5.8)	< .001	.878
Clarity	11.6 (4.0)	10.17 (3.1)	9.9 (3.4)	11.0 (4.0)	9.8 (3.2)	8.9 (2.6)	< .001	.996
Depression	9.3 (7.9)	7.8 (7.0)	7.1 (9.3)	9.0 (9.2)	7.9 (6.8)	4.8 (6.7)	.001	.779
Anxiety	7.9 (7.8)	6.9 (6.8)	6.8 (8.8)	8.0 (8.2)	6.1 (6.8)	4.4 (4.7)	.166	.286
Stress	16.6 (9.0)	13.3 (7.4)	14.9 (9.9)	16.8 (11.2)	12.3 (7.4)	14.5 (6.7)	.012	.627
Optimism	16.6 (3.5)	17.3 (2.8)	17.8 (2.9)	16.2 (3.2)	17.1 (2.6)	17.6 (2.6)	.003	.304
SWLS	17.7 (4.0)	19.4 (3.9)	19.5 (3.9)	18.5 (4.1)	18.9 (3.8)	19.9 (3.6)	< .001	.407

Note. DERS – Difficulties in Emotion Regulation Scale; SWLS – Satisfaction with Life Scale.

DISCUSSION

Both intervention formats demonstrated measurable benefits for participants, reinforcing prior conclusions drawn in MBI effectiveness research (Creswell, 2017; Sommers-Spijkerman et al., 2021). However, the observed outcomes concerning anxiety reduction were somewhat unexpected when contrasted with existing literature (e.g., Sevilla-Llewellyn-Jones et al., 2018). Notably, the results did not strongly favour one delivery method over the other, suggesting that digitally administered MBIs may serve as a practical and accessible alternative to traditional face-to-face programmes.

Additionally, while the study revealed significant baseline differences between groups in mindful awareness, these discrepancies were only present before the intervention and did not persist afterward. This pattern may indicate a potential selection bias – where pre-existing differences in participant characteristics influenced group assignment – rather than a genuine interaction effect attributable to the intervention itself. This self-selection may have led participants who were already more favourably inclined towards mindfulness skills to choose what they perceived to be a less intensive format (online group). It remains to be seen whether this bias could have worked in favour of the online format, due to higher participant/intervention congruence, or against it, due to participants having less to gain from the exercises, although the former hypothesis is more likely considering that this difference in mindfulness levels coincides with gender differences favouring women in the online group. This is important because women tend to benefit more from mindfulness training (Rojiani et al., 2017). Additionally, the fact that Brazilian participants were considerably more likely to participate in the online format might suggest cultural differences in regard to format preferences, a highly unexplored area of research. Such findings underscore both the importance and the inherent challenges of constructing equivalent experimental and control groups in mindfulness research. Given the growing cultural and social perceptions surrounding mindfulness, self-selection biases may play a notable role in determining which individuals choose to enrol in MBI studies, further complicating efforts to ensure balanced group composition.

Wagner et al. (2014) conducted a non-inferiority study comparing an Internet-based versus face-to-face cognitive-behavioural intervention for depression. They found no significant differences between groups at post-test, although their in-person group showed significantly worse depression symptoms at follow-up. The authors offered some explanations regarding this disparity, believing that the online format might have necessitated increased autonomy from the participants, which helped them

retain what they had learned during the follow-up period. The PIM, like most MBIs, focuses on integrating mindfulness practices into the participants' daily lives, which might have helped reduce this effect. Wagner et al. (2014) also found significantly lower anxiety and higher well-being in their online group. Their findings contrast with the present results, where no significant effect was found for anxiety at follow-up. Although well-being levels in the present study at post-test mirror Wagner et al.'s (2014), the face-to-face group eventually "caught up" with the online group, which might, once again, support the hypothesis that the participants in these MBIs showed more continued practice after the intervention, dissipating any advantages for either modality found at post-test.

Although the research team was unable to locate any non-inferiority trials comparing an MBI in an online versus in-person modality, other authors, such as Portnoy et al. (2023), have found similar improvements in comparative studies for both well-being and self-compassion across modalities, supporting the current findings. Similarly, Compen et al. (2018) found that both MBCT and electronic MBCT (eMBCT) were able to outperform treatment as usual in reducing psychological distress and increasing mindfulness skills, which, although no comparisons were made between the two active conditions, further proves that both modalities show significant effectiveness.

LIMITATIONS AND FUTURE DIRECTIONS

The primary limitation of this study stems from its quasi-experimental design, which relied on a convenience sample of participants. Since students voluntarily enrolled in the programmes with prior knowledge of the intervention format (online or in-person), self-selection bias may have influenced the results. Individuals often have inherent preferences for certain delivery methods – some may be more drawn to the flexibility of digital interventions, while others might prefer the interpersonal engagement of face-to-face sessions. These predispositions could have affected participant engagement, adherence, and ultimately, the outcomes, making it difficult to isolate the true effect of the intervention format itself.

The findings may also have been biased by attrition bias – skewed findings caused by participants who share one or more characteristics having higher dropout than the remaining sample. Participants with lower stress levels were more likely to abandon the intervention, which could indicate diminishing returns related to stress, but not anxiety or depression. It is possible that, due to the more immediate effects of stress on the individual, the higher-stress participants gain faster returns from the intervention, improving

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adherence and engagement, while, conversely, those who are not stressed, but might be depressed or anxious, have comparatively delayed returns, making the intervention more demanding and leading to higher dropout. This hypothesis warrants further investigation. The present results highlight the importance of continuous feedback and dialogue between intervention participants and clinicians/facilitators.

Future studies should aim to replicate these findings while addressing the current limitations. One crucial improvement would be to ensure greater group equivalence at baseline by controlling for pre-intervention differences in mindfulness levels, psychological distress, or format preferences. Additionally, extending the follow-up period would help determine whether the observed benefits of MBIs are sustained over time or diminish after the intervention ends. Incorporating a broader range of assessment tools, such as biological markers (e.g., cortisol levels, heart rate variability), alongside self-report measures, could provide a more comprehensive understanding of mindfulness's effects. Finally, gathering qualitative data on participants' subjective experiences with the intervention (e.g., perceived usefulness, challenges, or engagement barriers) would offer valuable insights into the practical applicability and personal relevance of different MBI formats.

CONCLUSIONS

The findings of this study hold significant relevance in light of the rapidly expanding use of telehealth in mental health care. The results contribute to the growing body of evidence supporting the efficacy of online mindfulness-based interventions (MBIs), aligning with previous research demonstrating their effectiveness (Sevilla-Llewellyn-Jones et al., 2018). The ability to deliver a clinically effective intervention with a reduced financial burden and greater flexibility in time commitment represents a substantial advancement in accessible health care. Importantly, the study found no meaningful disadvantages in the online format of the PIM programme when compared to its in-person counterpart, while highlighting several practical advantages, such as convenience and scalability, that make it a compelling option for both practitioners and participants.

The results indicated that the PIM was effective at reducing anxiety, depression and stress levels while increasing optimism and well-being through both online and in-person modalities, although these results were not maintained for anxiety at a 3-month follow-up. This discrepancy between short-term and long-term outcomes might be due to limitations inherent to the study design. Differences found between findings at post-test and follow-up highlight the importance of maintaining sustained practice

after the intervention period has been completed to maintain therapeutic gains, particularly for anxiety-related symptoms.

Discussion on this study is limited by the scarcity of previous studies employing similar designs. Although the current findings demonstrate similar outcomes between in-person and online modalities, it is important to replicate these results and perhaps invest into longer follow-up times, as these might exacerbate potential group differences. Future research should prioritize randomized controlled designs to mitigate potential biases associated with convenience sampling. Additionally, investigating alternative online delivery methods, such as asynchronous interventions (e.g., pre-recorded sessions with self-guided practice) compared to synchronous (live online) or traditional in-person formats, could provide valuable insights into the most effective and scalable approaches for mindfulness-based care.

DISCLOSURES

This research received no external funding. The study was approved by the Bioethics Committee of the Faculty of Human and Social Sciences, University of Algarve, Portugal (Approval No. EDOC/2018/19967).

The authors declare no conflict of interest.

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Face-to-face
& online MBI