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ORIGINAL PAPER

# Promotion of Psychological Well-Being and Life Satisfaction in Pre-Adolescents Through Mindfulness Amidst COVID-19

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## Abstract

**Objectives** Mindfulness-based programs (MBPs) seem to be a popular way to develop pre-adolescents' regulation abilities, psychological health, and life satisfaction, especially in difficult times. However, research into the effects of MBPs and factors influencing their effectiveness is still scarce and mixed. In the interest of understanding how MBPs can effectively be used to enhance pre-adolescents' regulation abilities, psychological health, and life satisfaction, this study aimed (a) to analyze and compare the effects of two 16-week-MBPs with different implementation dosages and (b) to evaluate the moderating role of participants characteristics on MBP effects.

**Method** During the COVID pandemic, we conducted this quasi-experimental study, in which we compared three groups of Portuguese sixth graders ($n = 105$): daily MBP group (one long plus four short lessons per week), weekly MBP group (one long lesson per week), and a control group receiving socioemotional instruction. In particular, we examined MBP effects on attentional control, emotion regulation, psychological distress, and life satisfaction. Also, we evaluated the moderating role of participants' gender, age, socioeconomic status, and baseline status on these effects.

**Results** In comparison to the other groups, the daily MBP showed lower expressive suppression and stress symptoms as well as higher life satisfaction. Moreover, both MBP groups reported greater cognitive reappraisal than the control group. While the effects of MBPs on emotion regulation were found to be moderated by gender, age, and baseline expressive suppression, no additional moderating effects were observed.

**Conclusions** These findings support the perspective that MBPs can serve as a broad preventive strategy, effectively promoting pre-adolescents' psychological health and life satisfaction during challenging times.

**Preregistration** This study is not preregistered.

**Keywords** COVID-19 pandemic · Mindfulness-based programs · Attentional control · Emotion regulation · Mental health · Life satisfaction · Pre-adolescence

Worldwide, one in seven people aged 10–19 years lives with a mental health disorder (World Health Organization, 2021). Fifty percent of mental disorders are established by age 14 (Kessler et al., 2005), but most cases are undetected and untreated (Children's Society, 2018). The high percentage of mental problems in pre-adolescence seems related to the fact that this developmental stage (age 11–14 years) is a vulnerable period marked by numerous physical and psychological developmental changes (Patton et al., 2016). During this stage of development, youth face several risks that may cause heightened psychological distress along with difficulties in the regulation of attention and emotions (World Health Organization, 2007). These risks, combined with external stressors (e.g., school evaluations, economic crises, war in Ukraine), elevated pre-adolescents into an especially vulnerable population. A particularly relevant stressor in present times was the COVID-19 pandemic.

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More and more evidence around the world showed that the pandemic strongly interfered with youngsters' mental health and life satisfaction (Jones et al., 2021; Loades et al., 2020). For example, research showed that, during COVID, Chinese children and adolescents were irritable, inattentive, and worried (Jiao et al., 2020); Canadian pre-adolescents experienced a decline in perceived mental health (Children First, 2020); Spanish children and adolescents showed emotional and behavioral alterations during the confinement (Pizarro-Ruiz & Ordóñez-Camblor, 2021); and Portuguese adolescents recognized the pandemic's negative impact on their physical and psychological health (Branquinho et al., 2020). These findings collectively highlight the severe impact of the COVID-19 pandemic on mental health across countries.

Consequently, governments have shown increased interest in developing effective means to help young people respond successfully to life challenges and prevent poor mental health (The Lancet Child Adolescent Health, 2020). Policymakers and researchers have emphasized that youth mental health must be firstly supported through early and preventive interventions in school contexts (Salloum et al., 2016; Vaillancourt et al., 2021a). Schools represent a primary setting for mental health promotion given the time students spend in this context, as well as the close relationship that school staff has with youth, their families, and community services. In addition to the ease, convenience, and cost-effectiveness of implementing interventions in a classroom context, providing whole-class activities diminishes stigma, inequalities, and social evaluations (Sapthiang et al., 2019). Currently, the fundamental mission of schools worldwide is not only to teach essential academic skills but also to promote students' protective factors against mental illness (Vaillancourt et al., 2021b). Educational mindfulness-based programs are a type of intervention increasingly popular in school contexts due to their effectiveness in promoting mental well-being (Carsley et al., 2018; McKeering & Hwang, 2019; Mettler et al., 2023; Phan et al., 2022; Phillips & Mychailyszyn, 2022; Zenner et al., 2014), even during pandemic times (Desai et al., 2021; Magalhães et al., 2022; Malboeuf-Hurtubise et al., 2021; Miller et al., 2021; Yuan, 2021).

Mindfulness-based programs (MBPs) seek to improve a particular kind of attention, characterized by a full awareness and acceptance of the present-moment internal (e.g., emotions) and/or external experiences (sounds) (Borquist-Conlon et al., 2019). To develop awareness and acceptance of those experiences, MBPs typically incorporate mindfulness meditations and reflective practices (Phan et al., 2022). Mindfulness meditations help individuals to focus their attention on the senses, body sensations, emotions, and thoughts with acceptance and kindness (Shapiro et al., 2006). Reflective practices allow individuals to learn about the functioning and regulation of their sensory and psychological experiences (Phan et al., 2022). These practices are expected to reduce cognitive rigidity and emotional distraction or reactivity (Zelazo & Lyons, 2012). In turn, this reduction may allow a cognitive and emotional rebalance that creates an opportunity for self-regulation (Blair & Dennis, 2008) and for the cultivation of an active acceptance stance toward experiences (Desrosiers et al., 2013). According to Wilson (1996), active acceptance involves a dynamic process, through which individuals stop focusing on the negative implications of an unchangeable situation and adopt a more positive perspective by actively accepting the facts. Rather than showing resignation to an undesired fate (i.e., passive acceptance), mindfulness allows individuals to become better not only at identifying and stopping negative thoughts and behaviors, but also at accepting things as they are. This stance may facilitate a broader tendency toward the use of adaptative emotion regulation strategies, such as cognitive reappraisal (Farb et al., 2012), which seems especially important in stressful circumstances. For example, Creswell and Lindsay (2014) showed that the increase of positive cognitive appraisals and the reduction of emotional reactivity was a crucial protective factor for mental health in facing adversity and trauma. These MBP-related gains have been observed regardless of participants' age and setting (e.g., educational, clinical). Yet, there has been a special interest in administering MBPs in educational contexts with pre-adolescents and adolescents. On the one hand, because this developmental period is full of risks, these programs seem useful by providing a universal preventive approach to promote protective factors against mental illness. On the other hand, this is also a period of opportunity because pre-adolescents seek for individuation and adjustment, as well as for the best mechanisms to deal with themselves and others (Patton et al., 2016).

In the educational context, MBPs seem potentially suitable for reducing psychological distress and generating welfare in pre-adolescence and adolescence during either less or more stressful times. Specifically, reviews and meta-analyses before the pandemic showed that MBPs not only improved students' cognitive and socioemotional competencies, resilience to stress, mental well-being, quality of life, and academic achievement but also decreased attention problems, negative affect, symptoms of anxiety, and stress (Carsley et al., 2018; Maynard et al., 2017; McKeering & Hwang, 2019; Mettler et al., 2023; Phan et al., 2022; Phillips & Mychailyszyn, 2022; Zenner et al., 2014). Despite the reduced number of studies during COVID-19, the same patterns of MBP benefits have been reported worldwide (Colaianne et al., 2022; Desai et al., 2021; Magalhães et al., 2022; Malboeuf-Hurtubise et al., 2021; Miller et al., 2021; Yuan, 2021). Research conducted during the COVID-19 pandemic showed that MBPs (a) improved Chinese students' resilience and emotional intelligence (Yuan, 2021), (b)

among American students, reduced anxiety and depression symptoms (Bazzano et al., 2022) and improved self-compassion, sense of interdependence, and perspective-taking (Colaianne et al., 2022), and (c) increased Portuguese students' attentional and emotional regulation skills as well as their school grades (Magalhães et al., 2022). Together these findings gathered before and during the pandemic provided promising evidence on the effectiveness of MBPs in educational contexts.

However, it should be noted that the evidence is not uniformly consistent. Review works found MBPs' effects neither on social and behavior outcomes (e.g., interpersonal skills) (Mettler et al., 2023) nor on depression symptoms (Phan et al., 2022). In an updated meta-analysis of randomized controlled trials, Dunning et al. (2022a) also found no beneficial effects of MBPs for well-being and no evidence of long-term benefits for cognitive skills, behavior, and mental health. Similar findings were reported by the MYRIAD (MY Resilience In ADolescence) project, which investigated the effectiveness, cost-effectiveness, and accessibility of school-based mindfulness training in adolescence before and during the pandemic. Moreover, there was no evidence of the superiority of a school-based MBP over the standard socioemotional education before the pandemic (Kuyken et al., 2022). During this period, the MYRIAD project also found no evidence that an MBP improved executive control or mitigated COVID-19 negative consequences on mental health (Dunning et al., 2022b). Raising some caveats about MBPs, this project suggested that school-based MBPs did not represent a universal intervention, and could be contraindicated for students with existing or emerging mental health symptoms (Montero-Marin et al., 2022). Based on these results, the MYRIAD project concluded that more research was needed to answer questions on what works, for whom, and how.

The inconsistent findings regarding MBPs' effects may be explained by the varying implementation features, such as the amount of mindfulness training provided (Tudor et al., 2022). As noted by Voils et al. (2012), "[d]osing is potentially the most important decision that must be made when building or refining behavioral interventions" (p. 1225). Likewise, Kabat-Zinn (1982) claimed that a key element for a mindfulness program to be helpful for individuals was its duration. Despite these acknowledgements, research has yet to provide sufficient reports of mindfulness intervention details regarding dosage, making it difficult to replicate studies and determining the minimum amount of training necessary to observe the changes often reported. Moreover, attempts to relate MBPs' dosage and effects provided different findings. A systematic review suggested that MBPs providing more mindfulness training and daily practice were associated with greater benefits in school contexts (Zenner et al., 2014). However, a meta-regression showed no evidence that larger doses were more helpful than smaller doses for predicting MBPs' psychological outcomes (Strohmaier, 2020). To the best of our knowledge, no study has directly compared the effects of MBPs with different mindfulness training dosages in pre-adolescence.

Other factors that may explain the mixed findings in the field relate to participants' characteristics, such as gender, age, socioeconomic status, and baseline scores, which may act as moderators of effectiveness (Tudor et al., 2022). Examining these moderators is crucial for identifying responsive and non-responsive participants, and for outlining adjustments or alternative approaches for non-responders (Kraemer et al., 2001). Also, moderators give new and constructive information to guide future research and treatment decision-making (Kraemer et al., 2002). Moderators of MBPs' effects have been hardly studied and available findings have been inconsistent. Though some studies found that gender and age did not moderate MBP effects (Johnson et al., 2017; Magalhães et al., 2022), other studies indicated that MBPs worked better for females (Galvez Tan & Alampay, 2022; Kang et al., 2018) and older students (Galvez Tan & Alampay, 2022; Van der Gucht et al., 2017). Although Magalhães et al. (2022) found that students' socioeconomic status did not moderate MBPs' effectiveness, correlational studies indicated that this variable moderated the link between trait mindfulness and mental health (Yuan et al., 2023). Other researchers found that the impact of socioemotional programs was reduced among low-status students (Malti et al., 2012). Concerning the role of participants' psychological profiles at the beginning of an MBP, whereas some studies showed greater effects among students with better cognitive and/or emotional abilities (Cordeiro et al., 2021; Fung et al., 2018; Magalhães et al., 2022), others did not confirm their influence on students' responsiveness (e.g., Van der Gucht et al., 2017).

In sum, available research is not only scarce and mixed but also far from informing about the most effective training dosage and the participants' characteristics that may moderate MBPs' benefits (McKeering & Hwang, 2019; Mettler et al., 2023; Phan et al., 2022; Phillips & Mychailyszyn, 2022). This study aimed to fill in this gap by comparing the effects of an MBP with a daily or weekly dosage with an active control group on a comprehensive set of measures, evaluating sixth graders' attentional control, emotion regulation, psychological distress, and life satisfaction. Additionally, we aimed to examine if the impact of the MBPs differed on participants' gender, age, socioeconomic status, and baseline status. Grounded on the previously reviewed evidence on MBPs' benefits in pre-adolescents (McKeering & Hwang, 2019), we expected that, compared to the active control group, both daily and weekly MBP groups would display more attentional control and emotion regulation, along with less psychological distress and more life

satisfaction. Though these benefits were expected among the two MBP groups, based on evidence suggesting that higher mindfulness training dosages may result in stronger benefits (Tudor et al., 2022; Zenner et al., 2014), we anticipated that the daily MBP group would surpass the weekly MBP group in all outcomes. Despite the mixed findings related to the moderating role of participants' characteristics, based on past evidence (Fung et al., 2018; Galvez Tan & Alampay, 2022; Kang et al., 2018; Magalhães et al., 2022; Malti et al., 2012; Van der Gucht et al., 2017), we expected that our MBP would work better for females and older pre-adolescents, as well as for those coming from higher socioeconomic status and displaying higher cognitive and emotional psychological profiles at baseline (i.e., better attentional and emotional skills, psychological health, and life satisfaction).

## Method

### *Participants*

This study involved eight Grade 6 classrooms from two public school clusters in Portugal. Due to the practical constraints imposed by the pandemic, these classrooms were selected based on teachers' interest to enroll their students in the study. Classrooms were then assigned to one of three conditions: daily MBP group (three classes), weekly MBP group (two classes), or active control group (three classes). To assure that the number of pre-adolescents per condition was balanced and to avoid different conditions being implemented within the same school, we used a non-random allocation procedure, with classroom size and school location as assignment criteria. The following exclusion criteria were set: no consent from the legal guardian ($n = 2$), presence of special education needs ($n = 12$), and absence during one or more assessments ($n = 6$). Thus, the final data-analytic sample included 35 pre-adolescents in the daily MBP group (participants in each classroom: $n = 10$, $n = 14$, $n = 11$; $M = 11.31$ years, $SD = 0.72$; 62% girls), 31 pre-adolescents in the weekly MBP group (participants in each classroom: $n = 14$, $n = 17$; $M = 11.43$ years, $SD = 0.57$; 42% girls), and 39 pre-adolescents in the active control group (participants in each classroom: $n = 10$, $n = 14$, $n = 15$; $M = 11.13$ years, $SD = 0.41$; 40% girls). The mother's educational level, used as a proxy of the child's socioeconomic status, was as follows in the daily MBP/weekly MBP/active-control groups: 11/7/5% finished Grade 4, 17/23/15% completed Grade 6, 26/29/10% completed Grade 9, 26/36/23% finished high school, 20/4/36% finished college and/or postgraduate studies, and 0/3/10% was unknown. The three groups were comparable in terms of age, $F(2, 103) = 2.50$, $p = 0.09$, gender, $\chi^2(2) = 4.20$, $p = 0.12$, and socioeconomic status, $\chi^2(8) = 14.94$, $p = 0.06$.

### Procedure

**Intervention Programs** In the daily and weekly MBP groups, the program was delivered in one 45-min weekly session for 16 weeks. Each classroom participated in the session on different days, according to participants' school schedule. Additionally, the MBP daily group participated in four 5-min sessions, delivered on the weekdays that followed the 45-min session. The program implemented in the active control group was delivered in one 45-min weekly session for 8 weeks. In the three groups, all sessions were implemented by trained instructors (i.e., classroom teachers or school psychologists with professional development certification in holistic teaching and wellness approaches). Instructors received a classroom kit, with an instructional manual, PowerPoint files for each session, and materials for the pre-adolescents (e.g., progress sheets).

**Mindfulness-Based Program** We used the already validated classroom-based "Be$^+$ HAPPI(ly)" program, which was found to improve fourth graders' dispositional mindfulness, composing quality, and mathematics grades (Limpo et al., 2023), as well as third graders' attention, emotional regulation, and school grades (Magalhães et al., 2022). Due to practical constraints, instead of implementing two sessions during 8 weeks, we implemented one session for 16 weeks. The program was aimed at developing children and pre-adolescents' abilities to stay aware and accept their experiences moment by moment. Students learned and practiced to focus their attention throughout six modules. Except for the first (introduction to the program) and last modules (consolidation of the learnings), each module included a set of meditations and reflective practices to develop students' ability to pay attention to different inner and outer targets (viz., senses, body sensations, feelings, and thoughts). A brief description of each session can be found on Supplementary Materials (Table S1). The 5-min sessions in the daily MBP group included audio meditation practices to reinforce awareness and acceptance skills related to the attention target of the week.

**Socioemotional Program** Despite a strength of this study was the inclusion of an active control, an imposition of the school to collaborate was the implementation of a program that was already being used by school staff. Thus, the classroom-based program implemented in the active control group was a restructured version of the evidence-based program "Slowly but Steadily" (Raimundo et al., 2013). This program was aimed at developing pre-adolescents' emotional knowledge and social competence. Its original version consisted of 21 sessions divided into five units. Because the contents of three units (self-awareness, understanding, and communication of emotions; social awareness, perspective

taking, and empathy; and emotion regulation — self-management) overlapped with those of the MBP, they were not implemented. Thus, the final implemented version consisted of 8 sessions divided into two units, targeting interpersonal skills, peer communication, and managing conflicts, as well as responsible decision-making and problem-solving skills. Students were enrolled in a sequenced set of group activities that emphasized learning by doing, interacting, and reflecting on social experiences. The strategies used in this program included didactic instruction, posters, storytelling activities, and brainstorming. A brief description of each session can be found on Supplementary Materials (Table S2).

**Fidelity of the Implementation** To guarantee the programs were implemented as planned, we provided all instructors with a pre-intervention workshop of 12 hr aimed to present the theoretical and empirical bases of the programs along with a set of 1-hr weekly sessions conducted throughout the programs' implementation to prepare and monitor the sessions. Also, we provided all instructors with checklists to indicate session steps' completion and eventual participants' absences. In the daily MBP group and the active control group, the six instructors reported to have implemented 95% of the planned steps of the 45-min sessions. In the weekly MBP group, they reported having implemented 97.5% of the planned steps of the 45-min sessions. Every time an instructor missed a step, he/she was asked to cover it in the next session. Regarding the 5-min sessions in the daily MBP group, all planned audio meditation practices were delivered according to the instructors' checklists. Finally, also according to the checklists across all conditions, no students missed more than two sessions or abandoned the program.

**Students' Assessments** Pre-adolescents were evaluated in the week before (baseline) and after (posttest) the implementation of the MBPs. A trained psychologist carried out the evaluation in one 30-min classroom group session. In this session, we used self-report questionnaires to measure students' sociodemographic characteristics as well as levels of attentional control, emotional regulation, psychological distress, and life satisfaction. After describing the procedure and giving the printed questionnaires to the pre-adolescents, the experimenter read aloud all items one at a time and the pre-adolescents responded simultaneously in their sheets. Help was provided as needed.

## Measures

**Attentional Control** The Attentional Control Scale for Children (ACS-C; Muris et al., 2004) was used. The ACS-C Portuguese version is an 11-item self-report questionnaire with 2 subscales: attentional focusing (7 items; e.g., "It's very hard for me to concentrate on a difficult task when there are noises aroundy") and attentional shifting (4 items; e.g., "I can become interested in a new topic very quickly when I need to"). Participants are asked to rate the degree to which they endorse each statement on a 4-point scale (from 1 = *Almost never* to 4 = *Always*). To compute the final score for each subscale, we averaged the responses of the corresponding items, with higher scores reflecting greater attentional control. In this sample, Cronbach's alphas were 0.77/0.77 at baseline/posttest for attentional focusing and 0.64/0.66 at baseline/posttest for attentional shifting; McDonald's omegas were 0.77/0.77 at baseline/posttest for attentional focusing and 0.65/0.68 at baseline/posttest for attentional shifting.

**Emotion Regulation** The Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA; Gullone & Taffe, 2012; Portuguese version: Teixeira et al., 2014) was used. This is a 10-item self-report measure with 2 subscales, which cover two emotion regulation strategies: cognitive reappraisal (6 items; e.g., "I control my emotions by changing the way I think about the situation I'm in") and expressive suppression (4 items; e.g., "I control my emotions by not showing them"). Participants are asked to indicate the level of agreement with each statement, using a 5-point scale (from 1 = *Strongly disagree* to 5 = *Strongly agree*). For each subscale, higher scores reflect greater use of the corresponding emotion regulation strategy. In this sample, Cronbach's alphas were 0.68/0.74 at baseline/posttest for cognitive reappraisal and 0.77/0.78 at baseline/posttest for expressive suppression; McDonald's omegas were 0.69/0.74 at baseline/posttest for cognitive reappraisal and 0.77/0.78 at baseline/posttest for expressive suppression.

**Psychological Distress** The Depression, Anxiety, and Stress Scale for children (DASS-21; Lovibond & Lovibond, 1995; Portuguese version: Leal et al., 2009) was used. This is a 21-item self-reported measure with 3 subscales: depression (7 items; e.g., "I couldn't seem to experience any positive feeling at all"), anxiety (7 items; e.g., "I was worried about situations in which I might panic and make a fool of myself"), and stress (7 items; e.g., "I found it difficult to relax"). Participants are asked to indicate how often they experienced each symptom described, on a 4-point scale (from 1 = *Never* to 4 = *Most of times*). For each subscale, higher scores reflect greater negative states. In this sample, Cronbach's alphas were 0.79/0.88 at baseline/posttest for depression, 0.84/0.85 at baseline/posttest for anxiety, and 0.81/0.75 at baseline/posttest for stress; McDonald's omegas were 0.80/0.88 at baseline/posttest for depression, 0.84/0.86 at baseline/posttest for anxiety, and 0.81/0.75 at baseline/posttest for stress.

**Life Satisfaction** The Students' Life Satisfaction Scale (SLSS; Huebner, 1991; Portuguese version: Marques et al.,

2007) was used. This is a 7-item unidimensional measure (e.g., "My life is going well"). Participants are asked to indicate how much they agree with each statement on a 5-point scale (from 1 = *Totally disagree* to 5 = *Totally agree*). Higher scores reflect greater general life satisfaction. In this sample, Cronbach's alphas were 0.81/0.88 at baseline/posttest; McDonald's omegas were 0.82/0.88 at baseline/posttest.

## Data Analyses

**Preliminary Analyses** Using the SPSS program (version 27.0), we performed the Little's Missing Completely at Random test to inspect the pattern of missing data. This test showed that the data were missing completely at random, $\chi^2(164) = 177.27$, $p = 0.28$, which allowed us to use a pairwise deletion technique as recommended for small samples (Garson, 2015). Then, we inspected if the skewness and kurtosis were below |3| and |10|, respectively, to guarantee the absence of severe distributional problems (Kline, 2016). Finally, we performed linear mixed modeling analyses to inspect if there was a classroom effect related to the nested nature of the data. Specifying group as a fixed effect and classroom as a random effect, results showed no significant effects of classroom for any outcome. Thus, for parsimonious reasons, classroom was not considered in the main analyses.

**Main Analyses** Firstly, we conducted multivariate analyses of variance (MANOVAs) to examine if there were baseline differences between the mean scores of the three groups (daily MBP, weekly MBP, active control group) in each set of dependent variables (attentional control, emotion regulation, psychological distress). For life satisfaction, the only unidimensional measure, we conducted a univariate analysis of covariance (ANCOVA).

Secondly, we conducted multivariate analyses of covariance (MANCOVAs) to examine group differences at posttest after controlling for the respective baseline scores. When the group effect was significant ($\alpha = 0.05$), we performed ANCOVAs for each dependent variable, controlling for the respective set of baseline scores. Significant group effects ($\alpha = 0.05$) were followed up with pairwise comparisons with Bonferroni adjustments. As recommended by Cohen (1988), the partial $\eta^2$ values of 0.01, 0.06, and 0.14 were interpreted as small, medium, and large effects, respectively.

Lastly, to evaluate the moderation role of gender, age, socioeconomic status, and baseline scores, we performed the same MANCOVAs for each set of variables (between-subjects = group, within-subjects = time, covariate = baseline scores), to which we added the main effect of the moderator along with its interaction with condition. As before, significant multivariate effects ($\alpha = 0.05$) were followed up with univariate tests. Significant interactions were decomposed using the PROCESS macro (version 3.5; Hayes, 2018).

## Results

Table 1 presents means and standard deviations for all baseline and posttest variables by group. Skewness and kurtosis of all variables were below |1.93| and |4.87|, respectively, demonstrating the absence of distributional problems (Kline, 2016).

### Effects on Attentional Control and Emotion Regulation

Concerning attentional control, the MANOVA on baseline scores revealed that before the program this skill differed

**Table 1** Means and standard deviations for all measures in each condition by testing time

| | Baseline *M* (*SD*) | | | Posttest *M* (*SD*) | | | Posttest $M_{adj}$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | Daily | Weekly | Active | Daily | Weekly | Active | Daily | Weekly | Active |
| Attentional control | | | | | | | | | |
| Attentional focusing | 3.05 (0.65) | 2.66 (0.54) | 2.83 (0.46) | 2.98 (0.60) | 2.77 (0.46) | 2.56 (0.56) | 2.98 | 2.82 | 2.59 |
| Attentional shifting | 2.36 (0.63) | 2.52 (0.67) | 2.46 (0.56) | 2.31 (0.71) | 2.57 (0.54) | 2.39 (0.62) | 2.31 | 2.56 | 2.41 |
| Emotion regulation | | | | | | | | | |
| Cognitive reappraisal | 3.74 (0.66) | 3.76 (0.56) | 3.70 (0.50) | 3.91 (0.66) | 3.95 (0.47) | 3.55 (0.56) | 3.91 | 3.95 | 3.53 |
| Expressive suppression | 2.81 (0.90) | 3.04 (0.80) | 3.16 (0.86) | 2.48 (0.76) | 3.19 (0.77) | 3.16 (0.83) | 2.48 | 3.19 | 3.13 |
| Psychological distress | | | | | | | | | |
| Depression | 1.66 (0.62) | 1.64 (0.55) | 1.61 (0.57) | 1.76 (0.66) | 1.72 (0.71) | 1.79 (0.71) | 1.76 | 1.66 | 1.81 |
| Anxiety | 1.48 (0.52) | 1.46 (0.50) | 1.49 (0.60) | 1.60 (0.59) | 1.64 (0.73) | 1.58 (0.58) | 1.60 | 1.58 | 1.56 |
| Stress | 1.64 (0.66) | 1.93 (0.54) | 1.80 (0.61) | 1.73 (0.49) | 1.83 (0.59) | 2.00 (0.55) | 1.73 | 1.80 | 2.02 |
| Life satisfaction | 3.51 (0.86) | 3.57 (0.56) | 3.45 (0.81) | 3.60 (1.01) | 3.49 (0.89) | 3.18 (0.91) | 3.61 | 3.44 | 3.19 |

$M_{adj}$, posttest means adjusted for baseline scores

between groups, Wilks' $\Lambda = 0.90$; $F(4, 210) = 2.78$, $p = 0.03$, $\eta_p^2 = 0.05$. However, follow-up ANCOVAs showed no statistical differences between groups. The main MANCOVA showed a significant effect of baseline attentional focus, Wilks' $\Lambda = 0.79$, $F(2, 95) = 12.92$, $p < 0.001$, $\eta_p^2 = 0.21$, and of baseline attentional shift, Wilks' $\Lambda = 0.79$, $F(2, 95) = 12.47$, $p < 0.001$, $\eta_p^2 = 0.21$. Additionally, there was a significant group effect, Wilks' $\Lambda = 0.84$, $F(4, 190) = 4.37$, $p = 0.002$, $\eta_p^2 = 0.08$. Follow-up ANCOVAs (see full results in Table 2) indicated an association between baseline and posttest attentional focus ($p < 0.001$), as well as between baseline attentional shift and posttest attentional focus and shift ($p = 0.001$ and $p < 0.001$, respectively). Also, the posttest scores of the daily and weekly MBP group on attentional focus were higher than those of the active control group ($p = 0.02$ and $p = 0.002$, respectively). However, a closer look into group means suggested that these significant differences could be due to a decrease in the scores of the active control group from pretest to posttest, rather than an increase in that of the MBPs groups. This was confirmed by paired-sample *t*-tests, which showed a significant decrease in attentional focus from pretest to posttest in the control group, $t(38) = 3.69$, $p < 0.001$, both no baseline-posttest difference in the MBPs groups.

For emotion regulation, the MANOVA on baseline scores showed no group differences, Wilks' $\Lambda = 0.97$, $F(4, 212) = 0.73$, $p = 0.57$, $\eta_p^2 = 0.01$. The subsequent MANCOVA revealed a main effect of baseline cognitive reappraisal, Wilks' $\Lambda = 0.75$, $F(2, 98) = 16.55$, $p < 0.001$, $\eta_p^2 = 0.25$, and of baseline expressive suppression, Wilks' $\Lambda = 0.67$, $F(2, 98) = 24.35$, $p < 0.001$, $\eta_p^2 = 0.33$, as well as a significant group effect, Wilks' $\Lambda = 0.67$, $F(4, 196) = 7.12$, $p < 0.001$, $\eta_p^2 = 0.13$. Follow-up ANCOVAs (see full results in Table 3) indicated an association between baseline and posttest cognitive reappraisal ($p < 0.001$), as well as between baseline and posttest expressive suppression ($p < 0.001$). Concerning posttest group differences, both the daily and weekly MBP groups reported higher cognitive reappraisal than the active control group ($p = 0.02$ and $p = 0.01$), and the daily MBP group reported lower expressive suppression than both the weekly MBP and active control groups ($p = 0.001$ and $p = 0.01$, respectively).

**Table 2** Estimates of the condition effects on attentional control (in bold) controlling for baseline scores

| Predictors | $F(1, 100)$ | $p$ | $\eta_p^2$ |
|---|---|---|---|
| Posttest attentional focusing | | | |
| Baseline attentional focusing | 25.37 | < 0.001 | 0.21 |
| Baseline attentional shifting | 1.10 | 0.30 | 0.01 |
| Condition | 6.62 | 0.002 | 0.12 |
| Posttest attentional shifting | | | |
| Baseline attentional focusing | 12.27 | 0.001 | 0.11 |
| Baseline attentional shifting | 21.47 | < 0.001 | 0.18 |
| Condition | 1.25 | 0.29 | 0.03 |

**Table 3** Estimates of the condition effects on emotion regulation (in bold) controlling for baseline scores

| Predictors | $F(1, 104)$ | $p$ | $\eta_p^2$ |
|---|---|---|---|
| Posttest cognitive reappraisal | | | |
| Baseline cognitive reappraisal | 27.59 | < 0.001 | 0.22 |
| Baseline expressive suppression | 2.55 | 0.11 | 0.03 |
| Condition | 5.99 | 0.004 | 0.11 |
| Posttest expressive suppression | | | |
| Baseline cognitive reappraisal | 2.44 | 0.12 | 0.02 |
| Baseline expressive suppression | 42.54 | < 0.001 | 0.30 |
| Condition | 7.73 | 0.001 | 0.14 |

## Effects on Psychological Distress and Life Satisfaction

Regarding psychological distress, the MANOVA on baseline scores revealed that before the intervention these symptoms differed between groups, Wilks' $\Lambda = 0.87$, $F(6, 200) = 2.41$, $p = 0.03$, $\eta_p^2 = 0.07$. However, follow-up ANCOVAs showed no statistical differences between groups. The main MANCOVA showed an effect of baseline anxiety, Wilks' $\Lambda = 0.83$, $F(3, 90) = 6.14$, $p = 0.001$, $\eta_p^2 = 0.17$, and baseline depression, Wilks' $\Lambda = 0.80$, $F(3, 90) = 7.51$, $p < 0.001$, $\eta_p^2 = 0.20$. Also, there was a significant group effect, Wilks' $\Lambda = 0.84$, $F(6, 180) = 2.66$, $p = 0.02$, $\eta_p^2 = 0.08$. Follow-up ANCOVAs (see full results in Table 4) indicated that baseline depression was associated with posttest depression ($p = 0.001$), and

**Table 4** Estimates of the condition effects on psychological distress (in bold) controlling for baseline scores

| Predictors | $F(1, 98)$ | $p$ | $\eta_p^2$ |
|---|---|---|---|
| Posttest depression | | | |
| Baseline depression | 12.09 | 0.001 | 0.12 |
| Baseline anxiety | 0.01 | 0.91 | < 0.001 |
| Baseline stress | 3.03 | 0.09 | 0.03 |
| Condition | 0.34 | 0.71 | 0.01 |
| Posttest anxiety | | | |
| Baseline depression | 2.49 | 0.12 | 0.03 |
| Baseline anxiety | 13.78 | < 0.001 | 0.13 |
| Baseline stress | 9.74 | 0.002 | 0.10 |
| Condition | 0.12 | 0.89 | 0.002 |
| Posttest stress | | | |
| Baseline depression | 1.48 | 0.23 | 0.02 |
| Baseline anxiety | 0.01 | 0.94 | < 0.001 |
| Baseline stress | 0.01 | 0.91 | < 0.001 |
| Condition | 3.63 | 0.03 | 0.07 |

that baseline anxiety and stress were both related with posttest anxiety ($p < 0.001$ and $p = 0.002$, respectively). Posttest group differences were only found for stress. Specifically, the daily MBP group displayed lower stress than the active control group ($p = 0.03$).

For life satisfaction, the ANOVA on baseline scores showed no group differences, $F(2, 109) = 0.37$, $p = 0.70$, $\eta_p^2 = 0.01$. The subsequent ANCOVA on posttest life satisfaction revealed a significant effect of baseline life satisfaction, $F(1, 98) = 94.35$, $p < 0.001$, $\eta_p^2 = 0.49$, and of group, $F(2, 102) = 3.41$, $p = 0.04$, $\eta_p^2 = 0.07$. At posttest, the daily MBP group reported higher life satisfaction than the active control group ($p = 0.03$).

### Moderators of Effectiveness

While socioeconomic status did not moderate the programs' effectiveness, gender, age, and baseline scores were found to moderate the above-reported effects, as detailed below.

Both gender and age moderated group effects on emotion regulation, Wilks' $\Lambda = 0.87$, $F(4, 190) = 3.41$, $p = 0.01$, $\eta_p^2 = 0.07$, and Wilks' $\Lambda = 0.88$, $F(4, 188) = 3.17$, $p = 0.02$, $\eta_p^2 = 0.06$, respectively. Univariate analyses revealed that whereas gender moderated group effects on expressive suppression ($p = 0.02$), age moderated group effects on cognitive reappraisal ($p = 0.01$). Specifically, for male pre-adolescents, the weekly MBP group resulted in higher expressive suppression than both the daily MBP group (effect = 0.92, $t = 4.20$, $p < 0.05$) and the active control group (effect = 0.54, $t = 2.86$, $p = 0.01$). Furthermore, the weekly MBP group resulted in higher cognitive reappraisal than both the daily MBP group (effect = 0.38, $t = 2.31$, $p = 0.02$) and the active control group (effect = 0.79, $t = 3.76$, $p = 0.004$), for pre-adolescents aged 11.26 and 11.85 years or more, respectively.

Baseline scores moderated group effects on both attentional control and emotion regulation. Regarding attentional control, MANCOVAs revealed that group interacted with baseline scores on attentional focus, Wilks' $\Lambda = 0.90$, $F(4, 182) = 2.49$, $p = 0.05$, $\eta_p^2 = 0.05$, and attentional shift, Wilks' $\Lambda = 0.86$, $F(4, 182) = 3.49$, $p = 0.01$, $\eta_p^2 = 0.07$. Univariate analyses revealed that these two interactions were only significant for posttest attentional focus (both $p$s = 0.01). However, when we decomposed significant condition-by-moderator interactions using PROCESS, no moderation effects were found.

As for emotion regulation, the MANCOVAs revealed a significant interaction between group and baseline expressive suppression, Wilks' $\Lambda = 0.88$, $F(4, 188) = 3.21$, $p = 0.01$, $\eta_p^2 = 0.06$, which, as revealed by univariate tests, only occurred for posttest expressive suppression ($p = 0.01$). Specifically, for pre-adolescents with baseline expressive suppression scores equal to or above 3, the daily MBP group resulted in lower suppression scores than both the weekly MBP group (effect = −0.65, $t = -3.96$, $p = 0.03$) and the active control group (effect = −0.25, $t = -3.18$, $p = 0.01$).

## Discussion

This study had a twofold aim. First, it sought to analyze and compare the effects of two 16-week mindfulness-based programs (MBPs) with different implementation dosages — daily (one long plus four short lessons per week) and weekly (one long lesson per week) — against an active control group during the COVID-19 pandemic. Second, it aimed to evaluate the moderating role of pre-adolescents' gender, age, socioeconomic status, and baseline psychological profile on the effects of MBPs. Results revealed that, regardless of the dosage, both MBP groups showed greater cognitive reappraisal than the control group. Moreover, the daily MBP group showed lower expressive suppression and stress symptoms as well as higher life satisfaction than the other two groups. We also found that MBPs' effects on emotion regulation strategies were moderated by gender, age, and expressive suppression baseline scores.

Despite initial analyses indicating a superiority of the two MBP groups over the active control group in terms of attentional focus, a closer inspection of this result revealed no changes from pretest to posttest among MBPs' participants. So, contrary to our expectations, pre-adolescents in the MBP groups did not show improvements in attentional focus. A similar result was observed for attentional shifting. This lack of effects on attention replicated the findings reported by Limpo et al. (2023), who did not find benefits on self-reported measures of attention among fourth graders participating in the same MBP implemented here. While these findings might suggest that our MBP program fails to improve attentional skills, drawing such a conclusion may be premature. Indeed, another study using this MBP in Grade 3 (Magalhães et al., 2022), demonstrated improvements in children's attention, as reported by their teachers. Moreover, using a performance-based measure of attention (i.e., the Attention Network Task; ANT), Magalhães et al. (2022) also showed that children with better pretest attention skills showed better posttest attentional skills than their control peers, receiving a health-based program. A more plausible explanation for the lack of MBPs' effects on attention here observed could be the use of self-report measures to gauge attentional changes, which may not accurately reflect pre-adolescents' performance. Prior studies already found no significant associations between self-report and behavioral measures of attention (Reinholdt-Dunne et al., 2013; Todd et al., 2022). As attention is a key target of MBPs, further research seems needed to identify attentional measures that are accurate and sensitive to change induced by mindfulness training.

This study confirmed the key role of emotion regulation in MBPs. Our results revealed that, at posttest, both daily and weekly MBPs groups reported greater use of cognitive reappraisal strategies than the active control group. By enabling

people to maintain attention on the immediate internal and external experiences (Brown & Ryan, 2003), our MBP may have helped pre-adolescents to see reality from different perspectives as well as to identify and replace negative automatic thoughts with positive ones (Gross, 2014). This is an important finding because there is now much evidence showing that children and adolescents' ability to reappraise their thoughts is a protective factor against mental illness (Gross & John, 2003; Ma & Fang, 2019), mostly in challenging times (Magalhães et al., 2022).

However, it is important to note that only the weekly MBP group, and not the daily MBP group, showed cognitive reappraisal gains that were moderated by the pre-adolescents' age. Only the oldest pre-adolescents (with more than 11.26 years) in the weekly MBP group reported using more cognitive reappraisal strategies than their peers in the daily MBP and control groups. Our results suggest that a mindfulness program with one session per week was enough to improve the use of cognitive reappraisal among more mature pre-adolescents. A similar finding was already reported in the literature (Galvez Tan & Alampay, 2022). This age-related effect may be explained by differences in students' cognitive maturation (Kaunhoven & Dorjee, 2017) combined with the less intense structure of the weekly MBP. Some researchers found that interval practice was more beneficial than consecutive practice for outcomes requiring latent learning (i.e., form of learning that remains hidden and only becomes observable when motivation and suitable circumstances arise; Cepeda et al., 2006; Molloy et al., 2012). This may be the case of cognitive reappraisal, as suggested by adult studies showing that the daily teaching of cognitive reappraisal strategies had limited benefits on emotion regulation (Ng & Diener, 2013), whereas the provision of training spaced 2–5 days had more sustainable gains (Denny & Ochsner, 2014). Given the well-established adaptative value of cognitive reappraisal (Aldao et al., 2010; Hu et al., 2014), further research is needed to determine the optimal MBP dosage to increase the use of this strategy among pre-adolescents.

Concerning MBPs' effects on the other emotion regulation strategy assessed, we found that the daily MBP group reported less expressive suppression than both the weekly MBP and active control groups. By repeatedly favoring compassionate and non-judgmental attitudes (Brown & Ryan, 2003), the daily MBP practices may have reduced pre-adolescents' likelihood of suppressing their emotions (Gross, 2014). This advantage of daily training over weekly training was only observed among male pre-adolescents, which contrasts with past studies that either found stronger MBP effects among females (Galvez Tan & Alampay, 2022; Kang et al., 2018) or failed to find any gender effect (Magalhães et al., 2022; Van der Gucht et al., 2017). A possible reason for these inconsistent findings is the balanced representation of both genders in our sample. The authors of a meta-analysis concluded that, although evidence indicated that females may respond slightly better to MBP than males, the effect was minimal and could be due to males being underrepresented in most studies (Carsley et al., 2018). Another possible explanation for the male-related effect observed here may be the higher tendency for boys (vs. girls) to suppress their emotions (Chaplin & Aldao, 2013). In accordance, our analysis showed that the daily MBP only resulted in lower expressive suppression than the other two groups among participants with higher use of suppression before the intervention. This finding aligns with past studies suggesting that some MBPs may be more effective among pre-adolescents with elevated emotional problems (Dimidjian & Linehan, 2009; Fung et al., 2018). Yet, as we were not able to locate any other study in which males benefited more than MBPs than females in terms of expressive suppression, more research is needed to validate this finding and explore the underlying mechanisms.

A final note on the MBPs' effects on emotion regulation is worth considering. Whereas the effects on cognitive reappraisal benefited from weekly sessions and occurred among older participants, those on expressive suppression benefited from daily sessions and occurred among males. We do not see these findings as contradictory, but as a manifestation of key differences between these emotion regulation strategies (Gross & John, 2003). Cognitive reappraisal is an antecedent-focused strategy, which involves acting before complete emotional responses are activated and modifying the entire emotional course. Expressive suppression is a response-focused strategy that comes later in the emotion-generating process. It mainly alters the behavioral aspect of emotional responses, without directly reducing the subjective and physiological experience of negative emotions. Though it looks reasonable that MBPs' effects on such different strategies varied upon training dosage (weekly vs. daily) and participants' characteristics (age and gender), the underlying explanation is, however, a topic for future research. Indeed, despite the data showing that MBPs facilitate emotion regulation, the characteristics of interventions and recipients more suitable to develop one or other strategy are barely known.

Concerning effects on mental health, the daily program resulted in less perceived stress compared to the active control group, aligning with prior research (Dunning et al., 2022; Phan et al., 2022). This supports the hypothesis that the daily MBP benefited protective factors against mental illness, such as emotion regulation. As proposed by the mindfulness stress buffering account (Creswell & Lindsay, 2014), most effects of MBPs on stress are observed in contexts with high-stress participant groups. It seems that our daily MBP was an appropriate tool to buffer the adverse times

faced by our participants (i.e., adolescence and the COVID pandemic) by altering their stress appraisals and reactivity (Creswell & Lindsay, 2014). Yet, none of the MBPs reduced depression and anxiety symptoms, which is partially aligned with past findings. Recent meta-analyses (Dunning et al., 2019; Dunning et al., 2022a) concluded that mindfulness training did not change depression symptoms, but it did reduce anxiety ones. However, these works included studies comparing MBP groups with active and passive control groups among Western and Eastern youth samples. Another meta-analysis that made separate analyses according to the studies design and target population failed to find an anxiety reduction among Western MBPs' recipients vs. active control groups (Odgers et al., 2020). Together, these studies seem to suggest that, firstly, MBPs may not be more helpful than other psychological-based interventions in reducing anxiety (e.g., socioemotional learning or health education). Secondly, MBP effects on anxiety may depend upon culture. The idea that cultural factors influence the understanding of mindfulness (Haas & Akamatsu, 2019) and the expression of anxiety (Hofmann & Hinton, 2014) is not new. Yet, the reason why Western-based studies fail to show MBP effects on anxiety is not known (Odgers et al., 2020). Likely, it was related to the conceptualization of mindfulness underlying MBPs' design, as well as to the instruments used to measure anxiety and how participants perceive and describe their symptoms. As different patterns of findings seem to be emerging from mindfulness studies with Western and Easter samples, empirical explanations are warranted to deepen our understanding about how and for whom MBPs work.

Remarkably, the daily (but not weekly) MBP resulted in higher self-reported life satisfaction than the active control group. The benefits of daily MBPs on life satisfaction have also been reported in the past (Felver et al., 2017; Zenner et al., 2014) and represent a key finding, especially in challenging moments, because experiencing higher levels of life satisfaction is crucial for pre-adolescents to regulate, reduce, and cope with distress as well as to construct greater levels of positive mental health (Freire & Ferreira, 2020). In our study, the benefits on perceived life satisfaction were probably related to the MBP practices aimed to promote awareness of the present moment and to positive experiences, even in difficult times (Harnett et al., 2010). The fact that these practices were common to the weekly MBP program, which failed to increase life satisfaction, suggested that the daily practice was needed to foster pre-adolescents' positive evaluation of their life. This distinct role of daily practice has been suggested in the field (Tudor et al., 2022; Zenner et al., 2014). Yet, more studies seem needed to explore the underlying mechanisms (Huppert & Johnson, 2010).

Finally, three additional findings are worthy of discussion. First, excepting MBPs' effects on expressive suppression, the benefits of the daily MBP on cognitive reappraisal, stress, and life satisfaction occurred irrespective of participants' gender, age, socioeconomic status, and baseline psychological profile. This general lack of moderation effects reinforces the MBPs' universal preventive approach to promote pre-adolescents' protective factors against mental illness in pandemic times.

Second, the socioemotional program delivered in the active control group showed no significant benefits. We envision three reasons behind this lack of results: (a) our measures were selected to grasp MBPs' effects and did not include measures of social competence (e.g., interpersonal skills), targeted in the control group, (b) the implemented program did not include three units of the original program that overlapped with the MBP, and (c) the posttest assessment among control participants took place 8 weeks after the program's end (i.e., all participants were evaluated at the same time, once the MBP ended). We cannot rule out the possibility that these implementation and evaluation features minimized the effects of such a standard socioemotional program. Future research should replicate this study using the complete version of the socioemotional program as the comparison condition and a comprehensive assessment of their effects on relevant measures, collected right after the program's end. This may help to eliminate any alternative explanation for our findings and provide stronger evidence on the power of mindfulness practices (vs. psychoeducation) to improve socioemotional skills.

The third finding that deserves reflection concerns the posttest effect observed on attentional focus, which was due to control participants reporting lower attentional focus at posttest than at pretest. We have no plausible reason to believe that there was an actual decrease in the attentional skills of these pre-adolescents. A more likely explanation could be an overestimation of their attentional abilities at pretest compared to a heightened awareness at posttest. During the socioemotional training, participants engaged in exercises to improve behavioral awareness. Probably, through that training they gained a more accurate perception of their attention skills, which they did not have initially. Clearly, both this striking result and proposed explanation require additional testing.

## Limitations and Future Directions

Despite offering relevant insights on how school-based MBPs may benefit pre-adolescents mental health, this study includes four limitations, which may guide future research. First, due to several constraints imposed by COVID-19, our study followed a quasi-experimental design and used non-randomization procedures to allocate classrooms to groups. As we only included classrooms from interested teachers, we also did not perform power analyses

and end up with a small sample. In addition, as previously discussed, the control condition was not matched to the MBP conditions in terms of the duration of the interventions. These limitations may have restricted the power of the study and the generalization of the findings. Future studies should aim for true random experimental designs, larger samples, and groups with the same implementation time (Felver et al., 2017), which may reduce bias, provide a rigorous tool to examine cause-effect relationships between an MBP and outcomes, and promote findings' generalization.

Second, both proximal and distal outcomes were exclusive measured through self-report. Despite some advantages of these measures (e.g., in terms of mental health, children and adolescents have been shown to provide unique and informative; Deighton et al., 2014), their limitations are well-known (e.g., measurement error, assessment narrowing, recall and desirability biases; Bentley et al., 2019), and may justify the above-discussed lack of attentional effects. For a broader analyses of MBP outcomes, future studies should use multi-informant data (e.g., teachers or parents) (Felver et al., 2017), along with behavioral tasks, which may provide more valid, reliable, and comprehensive information. For example, MBPs' effects on attention can be explored through multi-method assessments, combining questionnaires with performance-based measures (Zenner et al., 2014).

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Third, did not incorporate a follow-up assessment to determine whether the results were kept over time. This information would have been relevant because, to the best of our knowledge, no study explored if the long-term MBPs' effects vary across training dosage. Also, though some studies already reported maintenance of MBPs' benefits (Solhaug et al., 2019), others found no evidence of sustained benefits at follow-up (Dunning et al., 2022a). Thus, the maintenance of MBPs' benefits should be further explored to understand if, how, and for how long would the benefits of our MBPs be sustained.

Four, the study was conducted in Portuguese schools and we did not examine the role of cultural factors on reported findings. As discussed earlier, the region of study seems a moderator of intervention effectiveness, particularly in what concerns anxiety symptoms (Odgers et al., 2020). So, we do not know the degree to which reported findings are specific to the Portuguese context and population, and generalize to other circumstances, including the absence of worldwide stressful events. Replication studies targeting different contexts and participants and eventually cross-cultural research on the effects of MBPs seem warranted.

Despite the abovementioned limitations, this study showed that our MBP was enough to promote Portuguese pre-adolescents' emotional skills, as well as to decrease stress and enhance life satisfaction during COVID-19. In addition to the program itself, the small groups (between 10 and 17 participants) may have also helped pre-adolescents to feel more comfortable during mindfulness practices and increase their involvement. Our study does not allow us to test this hypothesis, but such an intimate environment may have played a role in the benefits reported here. As published articles frequently provide no information on group size or show high variation, the degree to which group size may influence MBPs' effects may be worth exploring.

Though caution is advised in generalizing reported findings, this study represents one step forward toward the use of MBPs to prevent poor mental health and foster life satisfaction among pre-adolescents. Because they face several risks and opportunities, this period seems to be a sensitive window to provide them with tools to deal with biological and contextual challenges, as well as to pursue well-being. This study suggests that short daily sessions of educational MBPs could be a successful, convenient, and cost-effective approach to improving mental health among Portuguese pre-adolescents during the pandemic. Whether the effects of our MBPs are sustained across different countries, contexts, and developmental periods as well as in the post-pandemic circumstances are open questions. Indeed, in the current period, with more and more statistics suggesting heighted mental health problems among pre-adolescents (Marin et al., 2023), mindfulness training may be of great help. The encouraging findings on MBPs before and during the pandemic provide sufficient arguments to test the usefulness of these programs in developing the skills to effectively manage the academic and non-academic challenges raised by COVID-19.

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**Author Contribution** SM: conceptualization, methodology, data curation, writing—original draft preparation. LC: conceptualization, supervision. PO, CF, and CM: conceptualization, data curation, implementation of the intervention. TLe: supervision, writing-reviewing. TLi: conceptualization, methodology, writing—reviewing and editing.

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**Data Availability** All data are available at the Open Science Framework (https://osf.io/28dnb/).

## Declarations

**Ethics Approval** Approval for study was obtained from the ethics committee of Faculty of Psychology and Education Sciences University of Porto, Portugal, on March 22, 2021. The evaluation study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

**Informed Consent** Written informed consent for participation and research findings dissemination were obtained from pre-adolescents' legal guardians before the start of the study. After its goals and overall procedures were explained to participants, they were asked to give oral assent by raising their hands.

**Conflict of Interest** The authors declare no competing interests.

**Use of Artificial Intelligence** AI was not used.



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