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Improving Mental Health and Well-Being through Informal Mindfulness Practices: An Intervention Study

Rebecca Shankland*, Damien Tessier, Aurélie Gauchet and Céline Baeyens

Université Grenoble Alpes, Grenoble, France

Lionel Strub

Grenoble Ecole de Management, Grenoble, France

Background: Mindfulness-based programs have been shown to be effective in reducing stress, anxiety, and depression symptoms, and enhancing well-being. However, it remains unclear whether longer formal mindfulness practices are necessary to obtain such results. We therefore aimed to assess the effectiveness of a program (FOVEA, 8 weeks, 2h/week) which was only based on brief and informal practices. **Methods:** Using a switching replication design, participants (N = 139) were assigned to a FOVEA or a wait-list group, and completed the following self-report questionnaires online at three time points: perceived stress, anxiety, depression, satisfaction with life (dependent variables), and mindfulness (mediating variable). They also completed a daily practice diary. **Results:** Relative to the wait-list group, FOVEA participants showed significantly reduced perceived stress, anxiety, and depression, and increased satisfaction with life. These changes were completely mediated by increased mindfulness, and were maintained 2.5 months after the end of the program. The effect sizes were moderate to large. **Conclusions:** These results underline the potential benefits of a mindfulness informal practices program for the general population. This type of program could constitute a first step towards more formal practices once the motivation to practice has been enhanced by the perceived benefits of brief practices.

Keywords: anxiety, depression, intervention, mindfulness, perceived stress, satisfaction with life

INTRODUCTION

Mindfulness has been defined as a way of deliberately paying attention to one's moment-to-moment experiences with a non-judgmental attitude (Kabat-Zinn,

*Address for correspondence: Rebecca Shankland, Université Grenoble Alpes, LIP/PC2S, Chaire Mindfulness, Bien-être au travail et Paix économique, 38000 Grenoble, France. Email: rebecca.shankland@univ-grenoble-alpes.fr

2003). Numerous reviews and meta-analyses (e.g. Brown & Ryan, 2003; Chiesa & Malinowski, 2011; Chiesa & Serretti, 2009; Eberth & Sedlmeier, 2012; Goyal et al., 2014; Gu, Strauss, Bond, & Cavanagh, 2015; Hofmann, Sawyer, Witt, & Oh, 2010; Jayawardene et al., 2017; Khoury et al., 2013; Parsons et al., 2017) have identified the benefits of mindfulness on aspects of both physical health (e.g. pain management; immune system improvement) and psychological health (e.g. stress reduction, depression relapse, anxiety reduction, improvement in obsessive compulsive disorders, eating disorders and substance use, and enhanced well-being). Various mediating mechanisms have been shown to explain these beneficial effects, among which are reduced levels of mind-wandering and ruminations as attention is more focused on the present moment experience (e.g. Brewer, 2011; Heeren & Philippot, 2010), greater cognitive flexibility (Becerra et al., 2016; Lutz et al., 2008; Malinowski, 2013; Moore & Malinowsky, 2009), creativity (Colzato et al., 2012; Lebuda, 2016), acceptance and reduced experiential avoidance, which lead to higher levels of psychological flexibility (defined as the ability to persist with, or change, behavior when doing so serves valued ends; see Kashdan & Rottenberg, 2010). These mechanisms have also been associated with reduced psychopathology and increased sustainable well-being.

Currently, the most widespread and researched mindfulness-based program in the general population is the Mindfulness Based Stress Reduction program (MBSR, Kabat-Zinn, 1990). The MBSR is an 8-week program during which participants meet for a 2h (or 2.5h) session every week, and are asked to perform formal practices for 45 minutes per day, 6 days per week, as well as informal practices such as mindful eating or mindful walking. The efficacy of such a program depends on several moderators including motivation to practice, practice time, and frequency of practice throughout the program (e.g. Carson, Carson, Gil, & Baucom, 2004). More specifically, frequency is related to positive affect, positive emotionality, and vitality (Brown & Ryan, 2003). As the authors underlined, regular practice yields an ongoing attention orientation towards the present moment's experience, which should result in increased attention regulation, emotional awareness, and reduced avoidance and maladaptive automatic responses, as has been shown by several studies (Breslin et al., 2006; Hawley et al., 2013; Segal et al., 2002). Thus, in order to benefit as much as possible from the program, participants need to be self-disciplined in performing their daily practices. Indeed, consciousness has been shown to moderate the efficacy of mindfulness training (de Vibe et al., 2015). It thus appears to be crucial to be able to integrate mindfulness into everyday life activities and interactions (Brown & Ryan, 2003; Hanh, 1992, 2012). This integration has been shown to be associated with better health and increased well-being (Keune & Forintos, 2010), although other studies have also shown that formal practices lead to more positive health and well-being outcomes than informal practices (e.g. Carmbody & Baer, 2008; Hawley et al., 2013). The inconsistencies in the literature (see Khoury et al., 2013;

Toneatto & Nguyen, 2007; Vettese Toneatto, Stea, Nguyen, & Wang, 2009) might have been caused by the difficulty of measuring brief and informal practice time (e.g. Hawley et al., 2013), and by the scarcity of studies measuring practice time and frequency (as only two out of 24 studies reported in the review by Vettese et al. (2009) did so), and adherence to suggested practices (which only six of the studies reported in Vettese et al. (2009) considered).

Although some recent studies have analysed the efficacy of informal mindfulness practices on perceived stress, negative affect (for a meta-analysis, see Schumer, Lindsay, & Creswell, 2018), and well-being (Birtwell et al., 2019; Hanley et al., 2015), more research is needed to explore the effects of 8-week programs based on brief and informal practices only, which could be proposed as an alternative to formal mindfulness practices, having been designed as a means of progressively developing mindful attention and awareness in everyday life activities. Studies carried out on working populations have shown that most participants reported practicing mainly informal or brief formal exercises such as the 3 minutes' breathing space (e.g. Shapiro, Brown, & Biegel, 2007; Vettese et al., 2009). Although they are brief and informal, these practices were found to increase mindfulness and well-being. Thus, participant engagement, quality of practice, and the integration of these practices into everyday life appear highly important.

Based on the considerations mentioned above, we designed a study testing the efficacy of a program based only on informal mindfulness practices. To our knowledge, just one prior study has compared a mindfulness-based program including only brief and informal practices to a program including formal practices (Hindman, Glass, Arnkoff, & Maron, 2015). A program based on informal and brief mindfulness practices may be considered as a first step towards developing mindfulness, which can then be followed by other interventions which include more formal practices. Including formal practices at some point appears to be more effective than relying solely on brief and informal practices, as Hindman et al.'s research (2015) on a student population has shown. However, it appears to be useful to study the effects of informal and brief practices in more depth in order to adapt programs for different populations. This would help to better meet the needs of individuals (e.g. parents at risk of burnout who decline to take part in mindfulness-based interventions because of the practice time required), and to adapt to the possibilities afforded in each situation (Kazdin, 2007).

In order to carry out this study, we reviewed the existing methods of developing mindful awareness through informal/integrated practices. We defined integrated practices as paying intentional non-judgmental attention towards an ongoing everyday activity such as talking, shaking hands, listening to sounds, etc., rather than planning a specific time to meditate in a specific place (e.g. on a cushion in a peaceful room). A parallel can be drawn between formal and informal practices of physical activity: a person can practice by walking to work or

can decide to practice twice a week at the gym. The Vittoz method appeared to correspond to the criterion of integrated practice that should help to increase mindfulness in daily life. It also corresponded to the criterion of being well identified in France, with organisation and practitioner training available through the Vittoz Institute (IRDC) in Paris. This method was developed in 1925 by Dr Roger Vittoz in Switzerland. It is based on integrated practices which aim to reduce maladaptive automatic responses and enhance present moment attention. Inspired by oriental spiritualties and practices, Vittoz developed a method designed to enhance self-regulation through present moment attention practices. These practices are mainly based on the five senses and on acting with awareness (Mingant, 2007), and are considered as brief and informal mindfulness practices. We therefore decided to develop a program based on these specific present moment awareness practices without carrying out a validation study on the Vittoz method as such, having noted that an informal mindfulness-based intervention comprising these practices is classically used in Vittoz therapy. The program is called FOVEA (Flexibility, Open monitoring, based on the Vittoz method, to enhance Experiential Awareness; for more details, see the Methods section below).

The present study aimed to assess the efficacy of a health promoting informal mindfulness-based program on mental health and subjective well-being, using a switching replication design (Trochim & Donnelly, 2007). This design compares the evolution of a first experimental group to a wait-list control group in the first phase, and in the second phase the wait-list control group goes through the program and the results are compared to the first experimental group, which becomes the control group. We hypothesised that the participants would show reduced self-reported stress and anxiety and depression symptoms, and higher levels of life satisfaction than the wait-list control group. We also hypothesised that these changes would be maintained at 2.5 months post-program. Our third hypothesis was that these changes would be mediated by increased levels of self-reported mindfulness.

METHODS

As mentioned above, in order to test our hypotheses, we used a switching replication design (Trochim & Donnelly, 2007), in which the second group is on a waiting-list while the first group follows the intervention, and at the end of the first group intervention, the groups change places and the second group begins the intervention. The hypothesis is that changes in relation to the target variables occur in intervention group 1 at T2 compared to T1, while the wait-list control group has no changes regarding these variables, and then at T3 the second group joins the first group and experiences changes in relation to the variables, while the first group remains stable.

Participants

The choice of the number of participants was difficult in this study, as many mindfulness randomised controlled trials have previously been carried out on small samples of patients, and few prior studies have been carried out on non-clinical populations using similar measures to those in this research. As a review of mindfulness randomised controlled trials in the field of mental health interventions has shown (Coronado-Montoya et al., 2016), in order to have large effect sizes, trials need to include more than 95 participants. As the measurement attrition rate in intervention studies can be high, we decided to include twice as many participants before allocating them to the first FOVEA group or the wait-list group.

Participants (n = 200) were recruited in the general adult population through a flyer and via a website presenting the program as a stress reduction and mental health promotion program for participants who wished to develop mindful attention and awareness in everyday life (rather than through formal meditation practices). The participants were included in groups of 8–12 people, either starting immediately or starting 2.5 months later. Participants were randomly assigned to the FOVEA or the wait-list group by the coordinator from the Vittoz-IRDC association before they were invited to the first meeting. Block randomisation was decided before the participants called. They were informed of their inclusion in the first FOVEA group or in the wait-list group. The inclusion criteria were as follows: adults who agreed to come to the eight sessions. Exclusion criteria were as follows: self-reported diagnosed psychopathology; had received mindfulness or Vittoz training before. The exclusion criteria were indicated in the announcement of the study trial, and this information was requested again when the participants contacted the association in order to take part in the study. The questions asked were as follows: Do you currently have a psychopathology which needs medical and therapeutic assistance? Have you already participated in a mindfulness or Vittoz program?

A total of 139 participants completed the baseline measures out of the 200 who had initially contacted the association to take part in the study: 96 were in the first experimental group, and 43 were in the wait-list group. Socio-demographic data for each group are shown in Table 1 (for complete sample information details, see Supplementary Information S1). For both groups, the mean age was 46.18 years old (SD = 12.39; 81.6% females), without any significant difference between groups (p-value > .05).

The mean number of in-sessions per participant was 7.37 out of 8 in-sessions. Program attrition rates were very low, as only one participant had to stop the program—this was because of a chronic disease diagnosis. Comparatively, the measurement attrition rate was high, with only 69 participants (50%) responding at Time 3 (see flow diagram, electronic Supplementary Information file S2). However, ANOVAs showed that the participants who only completed one or two waves of measurement did not differ significantly from those who

TABLE 1
Socio-demographic Variables for Both Groups at Baseline

Variables	*Experimental Group (n = 96)*	*Wait-list Group (n = 43)*
Gender (% females)	79.6	86.0
Age M (SD)	45.12 (13.0)	48.49 (10.6)
Professional category (%)		
Managers	18.3	11.6
Higher intellectual professions	33.3	46.5
Technicians and associate prof.	6.5	11.6
Clerical support workers	15.1	9.3
Service and sales professionals	1.1	0.0
Craft workers	2.2	4.7
Retired	5.4	9.3
Unemployed	7.5	4.7
Student	10.8	2.3
Level of education (%)		
High school diploma	19.4	20.9
Second year higher education	14.0	9.3
Third year higher education	14.0	16.3
Fourth year higher education	16.1	11.6
Masters or more	36.6	41.9

M: mean; *SD*: standard deviation.

completed the three waves of measurement on the variables measured at Time 1, *F*s (1, 137) < 2.53, *p*s.

Procedure

This study was approved by the university's ethical committee (CERNI n° 2013-11-06-27), and carried out in accordance with the 1964 Helsinki declaration and its later amendments. In collaboration with the research institute on the Vittoz method (IRDC), an 8-week program was manualised in the same format as the MBSR program at that time (2–2.5h per week), comprising only brief and informal practices designed to increase awareness in everyday life activities (for program details, see Supplementary Information S3). FOVEA instructors were recruited from the national Vittoz association (for more details, see Supplementary Information S4). The ten instructors selected for this study had between two and 15 years' experience (M = 9.2 years of practice), and followed a further 2-day training course on the FOVEA protocol in order to use the FOVEA manual. Each instructor completed a follow-up workbook at the end of each session indicating the practices they had performed during the session and adding comments that would be useful for the research. This procedure enabled us to assess the extent to which the instructors followed the manual.

In order to measure the efficacy of the program, online questionnaires were completed by the participants after a presentation meeting at which all eligible participants signed a document to signify their informed consent. They then completed the set of online questionnaires before the intervention, after the eight sessions, and 2.5 months after the end of the program.

Measures

In order to test our first two hypotheses, we measured perceived stress, anxiety and depression symptoms, and satisfaction with life. To test the third hypothesis we included a mindfulness self-reported measure. Furthermore, in order to assess adherence to the program we measured brief mindfulness practice time through a practice diary which the participants were asked to complete each day (see Supplementary Information S5 for details on program adherence).

Mindfulness. The French version (Heeren, Douilliez, Peschard, Debrauwere, & Philippot, 2011) of the Five Facets Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2008) is a 39-item self-reported instrument which comprises the following dimensions: observing, describing, acting with awareness, accepting without judgment, and non-reactivity to inner experience. Items were rated on a 5-point Likert-type scale ranging from 1 (never or very rarely true) to 5 (very often or always true). All five scales showed satisfactory internal consistency (observing $\alpha = .75$; describing $\alpha = .88$; non-judging $\alpha = .89$; non-reacting $\alpha = .80$; acting with awareness $\alpha = .87$; total scale $\alpha = .90$). The correlations between the five subscales are shown in Supplementary Information file S6.

Perceived Stress. The French version (Quintard, 1994) of the 14-item Perceived Stress Scale was used (Cohen, Kamarck, & Mermelstein, 1983). It is a unidimensional scale. Responses in terms of frequency were rated on a Likert scale ranging from 1 (never) to 7 (often). Internal consistency was satisfactory for this scale ($\alpha = .86$).

Anxiety and Depression. The French version (Lépine, Godchau, Brun, & Lempérière, 1985) of the Hospital Anxiety and Depression scale (Zigmond & Snaith, 1983) was used. It comprises two seven-item subscales measuring anxiety and depression on a 4-point intensity or frequency scale depending on the item. Internal consistency was satisfactory for both scales (Anxiety $\alpha = .78$; Depression $\alpha = .76$).

Satisfaction with Life. Current life satisfaction was assessed using the French version (Blais, Vallerand, Pelletier, & Brière, 1989) of the Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). This scale is

composed of five items scored on a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Internal consistency was satisfactory for this scale ($\alpha = .88$).

Statistical Analyses. Due to the nested nature of the data, multilevel growth curve analyses (MGCAs) were performed to test the hypotheses, using Jamovi software, version 1.2 (The Jamovi Project, 2020). The flexibility of multilevel models allows the examination of inter-individual differences in intra-individual changes over time. Thus, MGCAs ensure unbiased estimates of the parameters which consider the hierarchical structure of longitudinal data (Singer & Willett, 2003). To examine change across time in relation to each condition for each dependent variable (i.e. Hypotheses 1 and 2), data were treated as a two-level hierarchical model (i.e. the three waves of measurement at level 1, and the participants at level 2).

Following the strategy suggested by Singer and Willett (2003), several models were tested. In a preliminary step, an unconditional model (Model 1) was tested which only contained an intercept and no explanatory variables, in order to partition the variance of each dependent variable into within-individual and between-individual components. This model was used to calculate the mean for the whole sample for the duration of the study. In step 2, the variables "time" and "condition" and the interaction "Time × Condition" were included in a linear growth curve model (Model 2) as fixed parameters. The time variable was centered on the first measurement (i.e. three waves of measurement, with wave 1 coded as 0, wave 2 coded as 1, and wave 3 coded as 2), and represented the linear change in the wait-list group over time. The variable "condition" (a dummy variable, in which the FOVEA group = 1, and the wait-list group = 0) tested whether the FOVEA group and the wait-list group differed at baseline (time = 0), and the interaction "Time × Condition" examined whether the linear rate of change over time differed across treatments. In step 3, the variable "time^2", and the interaction "time^2 × Condition" were added as predictors in a quadratic growth curve model. This latter model specifically examined Hypotheses 1 and 2 to test whether the trajectories of the FOVEA group and the wait-list group were non-linear due to the switching replication design.

To compare the models, the −2 log likelihood (i.e. the likelihood ratio test/deviance test; Heck, Thomas, & Tabata, 2014) was used, with lower values indicating a better model fit. Because of space restrictions, only Model 1 and Model 3 are presented here. The effect sizes were expressed via marginal *R*-squared, which describes the proportion of variance explained by the fixed factors (Nakagawa & Schielzeth, 2013). In order to examine the mechanisms at play (in relation to Hypothesis 3), path analyses were conducted with AMOS Version 7.0 (Arbuckle, 2006) using maximum-likelihood estimation. For the purpose of modelling changes in the potential mediators, we computed the change scores by subtracting the time 1 scores from the time 2 scores, then

used the change scores as mediator variables between the condition and the dependent variables. The condition (i.e. FOVEA = 1; control = 0) was specified as the predictor of mindfulness change, which in turn was specified as the predictor of stress change, anxiety change, depression change, and satisfaction with life change. Direct paths from the condition to the four dependent variables were also specified. In order to evaluate the overall model fit, several indices were used: the chi-square goodness-of-fit statistic, the Tucker–Lewis index (TLI), the Comparative Fit Index (CFI), and the root mean square error of approximation (RMSEA). According to Hu and Bentler (1999), CFI and TLI values above .95 and RMSEA values of less than .06 represent a good model fit. As in study 1, we used the khi^2/df ratio to neutralise the influence of the sample size (Tabachnick & Fidell, 2007). A bootstrapping method with n = 5,000 bootstrap resamples was employed to test the mediational hypothesis (Hayes, 2017). This approach allowed us to determine if the change in mindfulness mediated the relationship between the condition and the four dependent variables (i.e. an indirect effect). An empirical approximation of the sampling distribution of indirect effects was generated and used to construct 95% bias-corrected confidence intervals (CI) for the indirect effects. Point estimates of indirect effects are considered significant when zero is not contained in the CI (Hayes, 2017).

RESULTS

Preliminary Analyses

All the self-reported questionnaires reached satisfactory levels of internal consistency ($\alpha > .70$). The correlations indicated that most of the variables were inter-correlated (see Supplementary Information S7). More specifically, the correlation matrix showed that regardless of the time of measurement, the total mindfulness score was negatively correlated with perceived stress, anxiety, and depression, and positively correlated with satisfaction with life. Analyses of the instructors' workbooks showed that they had all delivered the practices in the manual, thus maintaining the fidelity of the program. In addition, the calculation of the intra-class correlation coefficients from the unconditional models confirmed that they were all above 5 per cent (from 27% to 79%), indicating a hierarchical structure in the data, and that multilevel analysis was appropriate (Bryk & Raudenbush, 1992). Then, the statistical assumptions associated with multilevel models were checked by exploring the residuals in the full conditional models. The results indicated a relatively normal distribution of the residuals, and no extreme outliers. Furthermore, plotting the residuals against the predicted scores of the dependent variables showed no major signs of heteroscedasticity.

Effects of Intervention

The aim was to measure the effects of the FOVEA program on mindfulness, perceived stress, negative affect (anxiety and depression), and satisfaction with life, using a switching replication design. Table 2 presents the results of the MGCAs on each of these five dependent variables. With respect to mindfulness, the results showed no significant main effect for Condition ($b = 2.31$, $p = .43$) or for Time ($b = -3.86$, $p = .42$), indicating that there was no difference in the first wave of measurement between the two groups, and that mindfulness did not increase significantly and linearly over time in the wait-list group. In addition, the results revealed a significant main effect for Time^2 ($b = 6.83$, $p = .003$), indicating a change in the trajectory of mindfulness over time in the wait-list group. More importantly, the results also showed significant Time × Condition ($b = 23.01$, $p < .001$) and Time^2 × Condition ($b = -13.07$, $p < .001$) interactions, indicating that the slope of change between the conditions was different. A visual inspection of Figure 1 shows that the mindfulness score increased in the FOVEA group from baseline to post-test, then levelled off from post-test to follow-up, while it remained stable from baseline to post-test, and increased from post-test to follow-up in the wait-list group. These factors explained 17 per cent of the variance in mindfulness. Although no specific hypotheses were set out regarding each subscale of the Five Facets Mindfulness Questionnaire, complementary analyses were performed in order to inform the researchers about the dimension involved. The results showed a significant difference between the groups on all the subscales (see Supplementary Information file S8).

Regarding perceived stress, the results showed no significant main effect for Condition ($b = 0.39$, $p = .77$) or for Time ($b = 3.41$, $p = .15$), indicating that there was no difference in the first wave of measurement between the two groups, and that perceived stress did not increase significantly and linearly over time in the wait-list group. In addition, the results revealed a significant main effect for Time^2 ($b = -3.55$, $p = .002$), indicating a stationary point in the trajectory of perceived stress over time in the wait-list group. More importantly, the results showed significant Time × Condition ($b = -11.60$, $p < .001$) and Time^2 × Condition ($b = 6.36$, $p < .001$) interactions, indicating that the slope of change between the conditions was different. A visual inspection of Figure 1 reveals that perceived stress decreased in the FOVEA group from baseline to post-test, and levelled off from post-test to follow-up, whereas it remained stable from baseline to post-test, and decreased from post-test to follow-up in the wait-list group. These factors explained 13 per cent of the variance in perceived stress.

Turning to anxiety, the results showed no significant main effect for Condition ($b = -0.20$, $p = .78$) or for Time ($b = 1.71$, $p = .14$), indicating that there was no difference in the first wave of measurement between the two groups, and that anxiety did not increase significantly and linearly over time in the wait-list

TABLE 2
Results of Multilevel Growth Modeling Analyses

	Mindfulness b (SE)	*Stress b (SE)*	*Anxiety b (SE)*	*Depression b (SE)*	*Satisfaction b (SE)*
Fixed effects					
Intercept	114.90 (2.44)***	28.61 (1.16)***	10.44 (0.61)***	5.97 (0.48)***	21.44 (0.91)***
Condition	2.31 (2.94)	0.39 (1.40)	−0.20 (0.73)	−0.38 (0.58)	1.18 (1.09)
Time	−3.86 (4.73)	3.41 (2.35)	1.71 (1.16)	2.25 (1.07)*	−0.98 (1.15)
time^2	6.83 (2.30)**	−3.55 (1.14)**	−1.86 (0.56)***	−1.76 (0.52)***	1.12 (0.56)*
Time × Condition	23.01 (6.06)***	−11.60 (3.00)***	−6.17 (1.49)	−4.97 (1.36)***	3.50 (1.48)*
Time^2 × Condition	−13.07 (3.04)***	6.36 (1.51)***	3.52 (0.74)***	2.68 (0.68)***	−1.89 (0.74)*
Random effects					
Level 1	122.32 (14.01)***	30.33 (3.46)***	7.37 (0.86)***	6.34 (0.73)***	6.98 (0.81)***
Level 2	141.58 (25.19)***	28.96 (5.54)***	9.06 (1.64)***	3.94 (0.96)***	30.78 (4.10)***
−2log V (model 1)	2576.79	2109.84	1711.65	1600.76	1799.40
−2log V (model 3)	2468.12	2035.36	1639.93	1553.71	1761.86
Effect size	0.17	0.13	0.13	0.11	0.04

Note: *$p < .05$; **$p < .01$; ***$p < .001$.

group. Further, the results revealed a significant main effect for Time^2 ($b = -1.86$, $p = .001$), indicating a stationary point in the trajectory of anxiety over time in the wait-list group. More importantly, the results showed significant Time × Condition ($b = -6.17$, $p < .001$) and Time^2 × Condition ($b = 3.52$, $p < .001$) interactions, indicating that the slope of change between the conditions was different. A visual inspection of Figure 1 confirms that the anxiety score decreased in the FOVEA group from baseline to post-test, and levelled off from post-test to follow-up, while it remained stable from baseline to post-test, and decreased from post-test to follow-up in the wait-list group. These factors explained 13 per cent of the variance in anxiety.

For depression, the results showed no significant main effect for Condition ($b = -0.38$, $p = .52$), indicating that there was no difference in the first wave of measurement between the two groups. In addition, significant main effects for Time ($b = 2.25$, $p = .36$) and Time^2 ($b = -1.76$, $p = .001$) were revealed, indicating that the trajectory of depression in the wait-list group first increased and then decreased over time. More importantly, the results showed significant Time × Condition ($b = -4.97$, $p < .001$) and Time^2 × Condition ($b = 2.68$,

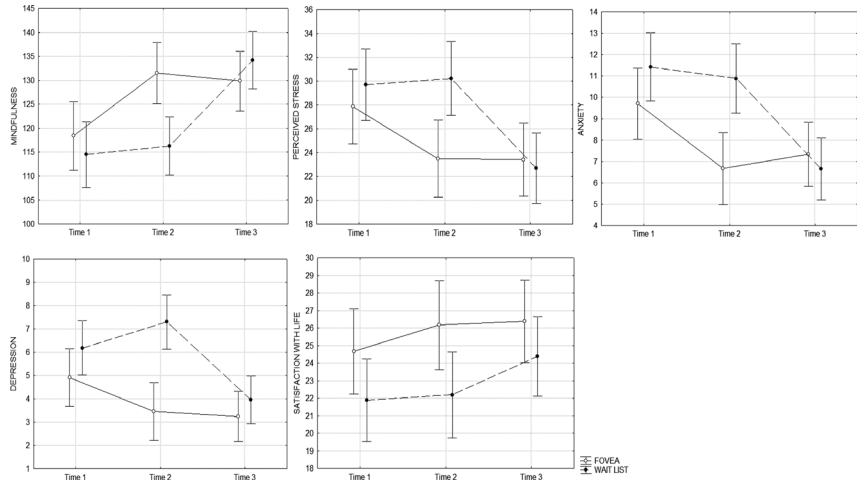

FIGURE 1. Intervention effects on mindfulness, stress, anxiety, depression, and satisfaction with life. *Notes*: In the switching replication design, from T1 to T2 the FOVEA group benefited from the program while the second group is on the wait-list. From T2 to T3 the wait-list group benefited from the program while the FOVEA group only completed a follow-up measure at T3. Each measurement time was separated by 2.5 months.

$p < .001$) interactions, indicating that the slope of change between the conditions was different. A visual inspection of Figure 1 shows that the depression score decreased in the FOVEA group from baseline to post-test, then levelled off from post-test to follow-up, whereas it remained stable from baseline to post-test, and decreased from post-test to follow-up in the wait-list group. These factors explained 11 per cent of the variance in depression.

Finally, with regard to satisfaction with life, the results showed no significant main effect for Condition ($b = 1.18$, $p = .28$) or for Time ($b = -0.98$, $p = .39$), indicating that there was no difference in the first wave of measurement between the two groups, and that satisfaction with life did not decrease significantly and linearly over time in the wait-list group. Moreover, the results revealed a significant main effect for Time^2 ($b = 1.12$, $p = .04$), indicating that the trajectory of satisfaction with life changed over time in the wait-list group. More importantly, the results indicated significant Time × Condition ($b = 3.50$, $p < .001$) and Time^2 × Condition ($b = -1.89$, $p < .001$) interactions, indicating that the slope of change between the conditions was different. A visual inspection of Figure 1 shows that the satisfaction score increased in the FOVEA group from baseline to post-test, then levelled off from post-test to follow-up, while it remained stable from baseline to post-test, and increased from post-test to follow-up in the wait-list group. These factors explained 5 per cent of the variance in satisfaction with life.

Mediation Analysis

We tested the models according to which the changes in perceived stress, anxiety, depression, and satisfaction with life were mediated by changes in self-reported mindfulness scores. The models specified yielded satisfactory fits across indices when covariating stress change scores with depression change scores, and anxiety change scores with satisfaction with life change scores, as suggested by modification indices: $\chi^2(12) = 13.91$, $p = .14$; $\chi^2/df = 1.54$; TLI = .94; CFI = .97; RMSEA = .06 [.00, .12]. As shown in Figure 2, compared to the control condition, the FOVEA condition positively predicted mindfulness change ($\beta = .32$, $p < .001$), which in turn was negatively related to stress change ($\beta = -.62$, $p < .001$), anxiety change ($\beta = -.62$, $p < .001$), and depression change ($\beta = -.38$, $p < .001$), and positively related to satisfaction with life change ($\beta = .45$, $p < .001$). This indirect effect of the condition on the four dependent variables represents a full mediation, as the direct effect of the condition on these variables was non-significant ($\beta = -.10$, *ns*; $\beta = -.06$, *ns*; $\beta = -.13$, *ns*; $\beta = .03$, *ns* for stress change, anxiety change, depression change, and satisfaction with life change, respectively). The bootstrap results indicated that the indirect effects of the condition on stress change, anxiety change, depression change, and satisfaction with life change was significant—with point estimates of .051, .062, .042 and .055, respectively—as zero was non-contained in 95% CI. Finally, the model explained 10 per cent of the variance in mindfulness change, 30 per cent of the variance in stress change, 39 per cent of the variance in anxiety change, 15 per cent of the variance in depression change, and 21, npath analysis (seeVPAn an autonomy-supportive mannery-supportive contextsal Consistency per cent of the variance in satisfaction with life change.

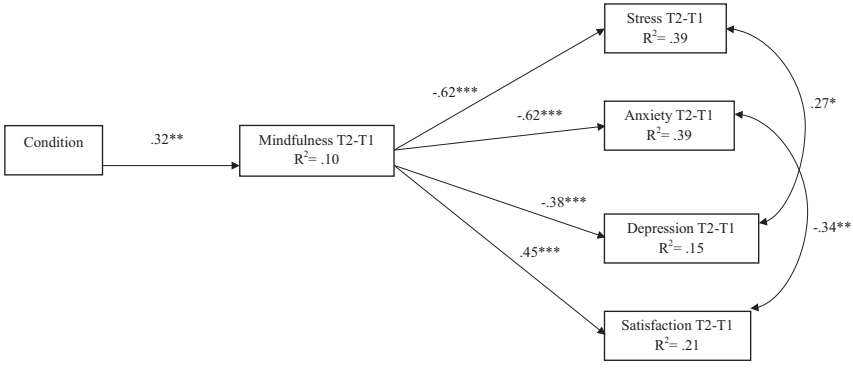

FIGURE 2. Mindfulness mediated the effects of experimental conditions on stress, anxiety, depression and satisfaction with life.*Notes*: Standardised paths coefficients are presented.*$p < .05$; **$p < .01$; ***$p < .001$.

DISCUSSION

The results of this randomised controlled trial suggest that the brief and informal 8-week mindfulness-based training (FOVEA program) showed reduced stress and negative affect (anxiety and depression symptoms) and increased satisfaction with life, and that these effects were maintained at 2.5 months post-intervention. The switching replication design enabled the findings from the first FOVEA group to be replicated, as the effects on the wait-list group after having benefited from the intervention (Time 3) were similar to those of the first FOVEA group. The effect sizes were moderate to large for mindfulness and anxiety, and moderate for perceived stress and depressive symptoms. These effects were totally mediated by the increased levels of self-reported mindfulness, which suggests that the integration of informal practices into everyday life can increase a person's mindfulness abilities. The complete mediation through mindfulness is in line with other studies which have underlined the effects of present moment attention and awareness on reduced negative affect (e.g. Josefsson, Larsman, Broberg, & Lundh, 2011; Serpa, Taylor, & Tillisch, 2014), as this helps individuals to reduce their tendency to anticipate the future with anxiety, or to ruminate on negative evaluations of past events or of the self (e.g. Jain et al., 2007). Importantly, this increase in mindfulness abilities (defined as a 12-point increase on the FFMQ) was comparable to the increases previously found in other studies carried out on standard mindfulness interventions such as MBSR (e.g. Kotsou et al., 2016). Furthermore, practice rates were high during the program, a finding which underlines the feasibility and adaptability of this intervention in various situations (including working, retired, and unemployed populations), and for a wide range of age groups (18–76 years old). The fact that no instructor effect was shown (i.e. no differences were observed between the various FOVEA groups carried out) indicates that the manual was probably sufficiently precise to enable instructors to carry out the program in the same way. This was reinforced by the fact that no specific problem was reported by the instructors concerning the FOVEA manual and practice workbook.

In line with recent research on the mechanisms explaining the efficacy of mindfulness-based programs, further studies may test hypotheses concerning the following specific mediators that could explain the effects of informal mindfulness practices such as those proposed in FOVEA. The first hypothesis concerns the effects of daily mindfulness practices on emotion regulation. Prior studies have shown that standard mindfulness programs such as MBSR (Kabat-Zinn, 1990) and MBCT (Mindfulness Based Cognitive Therapy; see Segal et al., 2002) increase emotion regulation abilities (for a recent review, see Guendelman, Medeiros, & Rampes, 2017). Emotion regulation includes the conscious and non-conscious strategies used by individuals to increase, maintain, or decrease components of their emotional responses (Gross, 1998). In FOVEA, the fact that practices are used in ecological situations and, therefore, can be used throughout

the day may help to increase the effect of mindfulness practices on emotion regulation, as these informal practices can easily be used in order to cope with intense emotions. A recent systematic review and meta-analysis of mindfulness-based programs (Gu et al., 2015) underlined the outcome of reduced repetitive thinking processes (ruminations and worries). These processes therefore represent a mediator that needs to be tested in research on informal mindfulness practices. An increased ability to regulate attention and emotions will lead to higher levels of psychological flexibility (the ability to respond to situations in various ways according to the specific context, as well as to the individual's aims and values; see Hayes, Strosahl, & Wilson, 2012). Psychological flexibility as a mediator of change could therefore be measured in future studies.

Another important mechanism that could explain how informal practices may lead to cognitive and psychological flexibility is related to top-down and bottom-up information processing. While FOVEA practices encourage participants to develop awareness and curiosity towards the information they receive through their five senses in everyday activities, this may lead to a reduction in the top-down interference which guides our perceptions of stimuli according to past experiences (for more details, see Bar's model, 2003). Although top-down guidance is useful in predicting and adapting to complex environments (Pezzulo, 2008; Pezzulo, Candidi, Dindo, & Barca, 2013), researchers have argued that a better balance is needed between top-down and bottom-up information processing in order to foster optimal adaptation (May, 2011). In line with past studies on mindfulness and brain changes (for a review and meta-analysis, see Fox et al., 2014) and in order to better understand the mechanisms at play (see Hölzel et al., 2011), further research should therefore explore the specific effects of informal mindfulness-based training on brain functions and structural changes in order to determine which of those changes are specifically due to formal meditation practices and thus cannot occur when only informal practices are carried out.

Although the results of this first controlled study underline the potential benefits of a brief and informal mindfulness practice program, some limitations must also be highlighted. First, this study relied only on self-reported measures. Such measures can give useful information on how participants feel; however, it would be useful to use non-self-reported measures to assess the mechanisms by which these effects on participants' subjective well-being and mental health are obtained. Indeed, recent reviews have reported the numerous biases involved in using self-reported measures in relation to mindfulness (Shankland, Kotsou, Cuny, Strub, & Brown, 2017), including the fact that before starting mindfulness-based interventions, participants often understand the items in a different way compared to when they have started practicing. Further studies should therefore aim to develop non-self-reported measures of mindfulness in order to more fully understand how these programs affect mental health and well-being. Second, although the FOVEA program attrition rate was remarkably low (as only

one participant dropped out), the measurement attrition rate was high, with only 69 participants (50% of participants) still participating at Time 3. This might have been because the link to the questionnaire was sent by email and there was no direct contact with the researchers at Time 2 and Time 3. Third, the comparison group was a wait-list control group. This enabled the present researchers to control for certain biases, but did not exclude the possibility that the effects were linked to a group gathering effect rather than an intervention effect. However, as the effects were totally mediated by increased mindfulness, the potential benefits of these specific practices were highlighted. Fourth, the wait-list group was smaller than the experimental group, which may have introduced bias into the results. However, the switching replication design enabled the observation of the same effects of intervention on the second group, while the first group remained stable.

In terms of research and applied perspectives, future studies on FOVEA should focus on replicating this study design in order to confirm the efficacy of this intervention while also using non-self-reported measures in order to explain the mechanisms by which informal mindfulness-based interventions can affect mental health and well-being.

Despite its limitations, this study on brief and informal mindfulness-based practices suggests that these practices might be useful for the general population in reducing stress and negative affect as well as enhancing overall satisfaction with life. The training given to the therapists appeared sufficient in helping them to carry out the program in a consistent way; this is encouraging regarding the generalisability of the program and its effects in the general population. Further research should be carried out with clinical populations in order to determine the specific impact on such populations.

Although no formal meditation practices were proposed in this study, levels of mindfulness increased after intervention and totally mediated the effects on the target variables. This corroborates the recent research carried out on single informal mindfulness practices such as mindful dishwashing, which showed increased state of mindfulness and positive affect (Hanley, Warner, Dehili, Canto, & Garland, 2015). The current study offers new perspectives for future research in terms of understanding the mechanisms by which mindfulness can lead to better mental health through integrated practices. It also offers new perspectives for clinical interventions among populations who are not willing to practice formal meditation, or who believe that they cannot find the time to practice as they are already overwhelmed by daily activities such as family and work duties.

DECLARATION OF CONFLICTING INTERESTS

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Supplementary Material