The Mindfulness Meditation Effect on States of Anxiety, Depression, Stress and Quality of Life

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Abstract: **Purpose:** This paper aims to study how mindfulness meditation can be used to prevent, or improve, states of anxiety, depression, stress and loss of quality of life. Although this model of meditation has been associated with a healthier life, there is a need for scientific evidence-based on longitudinal results. **Methods:** Twenty-five volunteers, asymptomatic of psychological distress, participated in this research project attending a Mindfulness-Based Stress Reduction (MBSR) course. The status of each individual was assessed for 18 weeks, with three scales: World Health Organization Quality of Life (WHOQOL), Profile of Mood States (POMS) and Depression, Anxiety and Stress Scale (DASS). There were four evaluation periods: Pre/Peri/Post-MBSR course and a fourth follow-up, after two months. **Results:** Comparing the beginning to the end of the MBSR course, a significant reduction was observed in mean results of self-reported anxiety: -66.0% (p<0.001), stress: -52.0% (p<0.001), depression: -51.0% (p<0.001) and Total Mood Disturbance (TMD): -19.0% (p<0.001), as well as an increase in quality of life: 11.2% (p<0.001). **Conclusion:** The current values suggest that the practice of mindfulness meditation, characterized by self-regulation of attention, can be used as a proactive way to prevent and respond to psychopathological disorders.

1 INTRODUCTION

Being healthy is much more than not being sick (World Health Organization, 2014), involving daily physical and mental well-being. The modern society, of which we are part of, imposes increasing personal responsibilities, an increasingly demanding professional activity and a constant connection to the technological world. New obligations arise daily, preventing a timely response to problems. There is no room to rest and the mind tends to walk into a state of stress. This vulnerable and unhealthy way of life is evidenced by a study published by the OCDE in which more than 80 million Europeans suffer from mental health problems (OECD, 2018). The search for a healthy and effective alternative, without using drugs, becomes a real demand. Mindfulness meditation comes as part of the solution to this type of disorder. It consists of a mental self-regulation technique of controlling attention and, consequently, the individual's well-being. Mindfulness, which underlies the principle of observing without judgment, calms the mind, acting not only from the therapeutic point of view but mainly by preventing or aiding a treatment of mental disorders that affect a large part of the population. This type of meditation has evolved worldwide with very significant results in the quality of life of its followers. There is a growing number of practitioners and countries such as England (Education et al., n.d.), Portugal (João Carvalho das Neves, João Pargana, 2019), Australia (Dobkin & Hutchinson, 2013) and the USA where Mindfulness has already become a curricular

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discipline (Weare, 2018) and also used as medical care (Vos & Vitali, 2018)(Kemper et al., 2016)(Mouzinho et al., 2018).

Several meta-analyses demonstrated positive effects of mindfulness meditation on stress, anxiety and depression (Spijkerman et al., 2016)(Li et al., 2017). Furthermore, by comparing Mindfulness to other types of meditation, such as Yoga, the first was shown to produce clearly superior effects (Virgili, 2015). Studies at various universities advise Mindfulness meditation as an effective method for calming stress levels among the student population (Galante et al., 2018). Nevertheless, the benefits of this practice need to be ascertained (Galante et al., 2016). Clinical situations such as chronic pain or low back pain (Hilton et al., 2017) might be relieved with the aid of Mindfulness (Anheyer et al., 2017). However, the temporal sequence in evaluations is required. Some approaches already address this need, such as the Mindfulness study of 104 international students at the University of Amsterdam being collected during four meditation course sessions (de Bruin et al., 2015).

Notwithstanding, a longitudinal study addressing different aspects of well-being and mental health is missing. There are several articles published based on WHOQOL survey. In a study conducted at a university hospital in Seoul, the effects of Mindfulness meditation on 50 nurses were evaluated. With an 8-week course, they found significant improvements in nurses' quality of life and increased positive emotional states (Chang et al., 2016). A meta-analysis of 96 studies with 7647 participants also found positive outcomes of the MBSR course on volunteer's quality of life (de Vibe et al., 2017) and relief of depressive symptoms (Manh Dang et al., 2018). Identical results, with clear improvements in the health status of each individual, were also revealed using POMS (Evans et al., 2018)(Garland et al., 2007) and DASS (McConville et al., 2017)(Kolahkaj & Zargar, 2015) surveys. The studies compared the states pre and post-course and revealed reductions in depression, which are more significant on anxiety and even more on stress.

Most papers published in this area only perform comparative studies between test and control groups in a single moment, disregarding the dynamics of the emotional states and the intrinsic nature of training, which demands continued practice (Tang et al., 2015). It is expected that after the participation in the MBSR course, psychological changes occur in the individual, providing a more positive life approach without known negative collateral damage. However, it is important to assess until when the effects persist.

The main objectives of this study were to specify the contribution of the current practice of Mindfulness meditation to the prevention and management of mood dysregulation such as anxiety, depression and/or stress. Three different surveys (DASS, POMS and WHOQOL-100) were used to evaluate the well-being subjects evolution. Longitudinal monitoring was carried out over 18 weeks, through 4 collection sessions, and the existence of only one test group was characterized in the first session and kept as the baseline for the subsequent sessions.

2 METHODS

The present study is based on the administration of a Mindfulness-Based Stress Reduction (MBSR) course to 30 individuals and its evaluation was performed over 18 weeks. Through a longitudinal approach, with records from 4 sessions, three scales assessed the current Quality of Life (QoL) of the participants, their mood state and the levels of depression, anxiety and stress.

2.1 Participants Recruitment and Sample Characterization

The participant's selection was made in a Portuguese University where this research work took place. Recruitment began with the dissemination of posters through *Facebook* and sent via e-mail to all faculty members, students and employees. Through a QR code/link, those who were interested, were provided access to a Web page with more detailed information such as the instructor's name, the sessions scheduled and the attribution of a certificate to all those who successfully completed it. For 15 days, an online mini-survey was active, allowing to pre-select the candidates. All those who did not belong to this academic environment already had training in Mindfulness or were not available to attend the entire course were excluded. The page registered 279 accesses with 35 applications, resulting in the rejection of 5 individuals (1 did not belong to the university, 3 already had Mindfulness training and 1 did not have full availability to attend the course). Subsequently, during the MBSR course, 5 individuals gave up (2 for health issues and 3 without justification), so the final population considered for this study was composed of 25 individuals (mean age = 26.0, SD = 7.1, 9 male) (Table 1).

Table 1: Sample characterization.

Age	Total	Male	Female	Master student	PhD student	Employee
<20	3	1	2	3	0	0
20-25	10	5	5	10	0	0
25-30	8	2	6	4	2	2
≥30	4	1	3	1	3	0

2.2 Mindfulness-based Stress Reduction Course

The MBSR training is specifically targeted to situations of stress, anxiety and depression(Grossman et al., 2004). It was developed to be trained in 8 lessons of 2 hours and 30 minutes each, one per week. In the 6th week, an intensive training session was prepared, usually on a Sunday, in a silent regime of "retreat", putting into practice the knowledge already acquired (Table 2).

Table 2: Plan for MBSR Training Course.

Mindfulness-Based Stress Reduction topics	Hours	Week of the year
Introduction to Mindfulness	2.5	21th
Perception	2.5	22th
Mindfulness of breath & body in motion	2.5	23th
Learning about our patterns of stress reaction	2.5	24th
Dealing with stress: Using Mindfulness to respond instead of to react	2.5	25th
Stressful communications and interpersonal Mindfulness	2.5	26th
(Silent retreat)	6.0	26th
Lifestyle choices: Take care of me	2.5	27th
Keep Mindfulness alive	1.5	28th

2.3 Online Surveys

The DASS, POMS and WHOQOL-100 inquiries were implemented through the *Google* Forms platform, collecting and pre-processing data. After the application submission, the selected volunteers received an SMS with a random alphanumeric 6 digits, corresponding to their personal and non-transferable identification. Personal data privacy is guaranteed using HTTPS protocol and this code authentication without any other identification.

In the four sessions scheduled, the DASS and POMS surveys were completed, with a 15-minute completion time. To avoid a time overload in the collection session, the WHOQOL-100 survey, estimated at 25 minutes, were answered online later, on the day itself. The surveys were answered at different stages of the academic calendar (Table 3).

Table 3: School Calendar during the 4 sessions surveys.

Session	Date (last 2 weeks)	Academic calendar
1st	May	School days
2nd	June	Exams
3rd	July	Special period of exams/ Paper submissions
-	August	Summer holidays (full month)
4th	September	School days

2.3.1 Depression, Anxiety and Stress Scale

The DASS, adapted to Portuguese with 21 questions (Pais-Ribeiro et al., 2004) and answered from 0 to 3, was developed for adults in order to evaluate a set of emotions and feelings, lived in the last week, and grouped in three basic structures: Anxiety, depression and stress. The issues related to anxiety include subjective experiences, skeletal muscle effects, autonomic system arousal and situational anxiety. Depression encompasses discouragement, lack of interest or involvement, inertia, self-depreciation and devaluation of life. Finally, stress encompasses irritability, nervous excitement, impatience, restlessness, and difficulty in relaxing. The healthiest individual will get a final score of 0 progressing to a maximum of 42, evolving from "*Normal*" to "*Medium*," "*Moderate*," "*Severe*," and "*Extremely Severe*". Although each state has a maximum value of 42, its classification varies according to each state analysis (Figure 1).

2.3.2 Profile of Mood States

POMS is an easy-to-respond and easy-to-use assessment instrument that evaluates mood states and psychological well-being (McNair et al., 1971). In the Portuguese adaptation (Faro Viana et al., 2012) 42 adjectives were used, identifying six state factors: Stress/Anxiety is represented by an increase of tension; Depression/Melancholy describes the emotional state of sadness, loneliness, unhappiness and discouragement; Hostility/Anger depicts a mood of anger or dislike of others; Vigor/Activity represents the state of energy and physical and
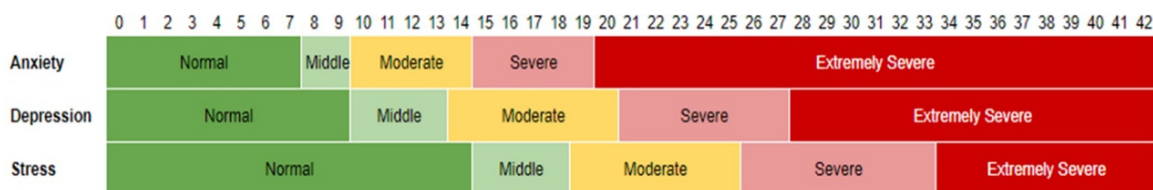
Figure 1: Qualitative/Quantitative Classification for Anxiety, Depression and Stress, using DASS scale.

psychological vigor; Fatigue/Inertia expresses a state of fatigue, inertia and reduced energy; and finally Confusion/Disorientation corresponds to a low lucidity and confused state. All questions were presented online, and evaluate the person status during the last week, on a scale of 0 to 4 (0="*Nothing*", 1="*A little*", 2="*Moderately*", 3="Fair" and 4="*Many*"). The final mood state is calculated through the sum of the states of tension, depression, hostility, fatigue and confusion, from which the state of vigor is subtracted. To avoid a negative final result, the value 100 is added to the sum. This TMD is represented by the final value obtained. A lower value represents a more positive mood state.

2.3.3 Quality of Life

The WHOQOL survey is intended to assess the quality of life of an individual, taking into account his "*perception and position in life in a cultural context and system of values in which he lives and in relation to his goals, expectations, standards and concerns*" (World Health Organization, 1998). The WHOQOL-100 consists of 100 questions adapted to the Portuguese population assessing the physical, psychological, independence, social relations, personal environment and spirituality/beliefs. Responses are given based on the individual experience during the past two weeks. The first 42 questions are related to positive feelings of happiness and contentment. The rating ranges from "*Nothing*" to "*Too Much*". The daily activities are assessed with 13 questions with a score of "*Nothing*" to "*Completely*", checking whether the subject experienced or was able to do certain things such as washing themselves or eating. The third phase includes 34 questions to evaluate if the individual felt satisfied, happy or well with various aspects of their life, ranging from "*Very dissatisfied*" to "*Very satisfied*". The 5th analysis phase includes 4 questions about the daily activities that take the most time and energy, varying the classification between "*Nothing/Very dissatisfied*" to "*Completely/Very satisfied*". Next, there are four more questions assessing an individual's physical ability to accomplish what they need to do by ranking "*Very

Bad/Not at All/Very Dissatisfied*" and "*Very Good/Very Satisfied*". Finally, the last four questions address personal beliefs and spirituality, with the responses varying between "*Nothing*" and "*Many*". Quality of life is then assessed quantitatively in all these six domains, from 1 to 5. The higher the result obtained, the more quality of life an individual has. This survey was completed only in the first, third and fourth sessions, with no data collection occurring on the second (Peri-MBSR). This decision occurred since filling this questionnaire is very time-consuming, and the major goal of the survey is to evaluate the changes before, after the course, and after two months.

2.4 Statistical Analysis

The statistical analysis was performed using a linear mixed-effects model. This approach is particularly appropriate to process longitudinal data with missing values. This model considers the independent effects of interest (fixed effects) and the variations that may occur (random effects). The model included one random effect (subjects) and one fixed effect (sessions). The analysis was performed using *FITLME* command of *Matlab* (MathWorks, 2020). The completed command was: lme = fitlme (tbl, formula), where *tbl* is the data table, previously structured in an adequate format, and formula='data~1+session+(1|patient)'.

3 RESULTS

The data related to DASS and POMS surveys in the four sessions (21 and 42 questions respectively), and the WHOQOL-100 survey (100 questions in 3 sessions), in a total of 13.800 responses, were processed. The datasets were labeled with "Pre", "Peri", "Post" and "Follow-Up", corresponding to "Pre-Course", "During Course", "Post-Course" and "2 Months after Course".
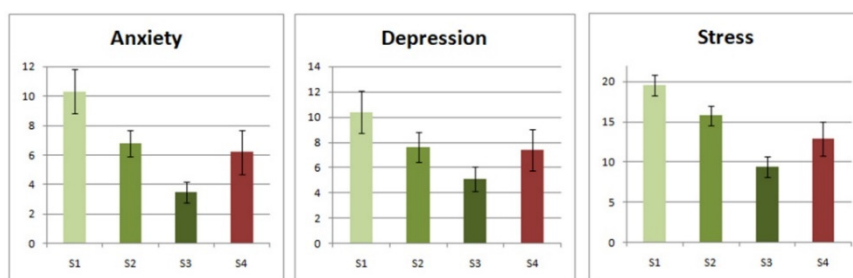
Figure 2: DASS survey averaged results for Anxiety, Depression and Stress (from 0 to 42), from session 1 (S1) to session 4 (S4), for the global sample. The error bars represent the standard deviation.

Table 4: DASS survey results (mean; standard deviation, SD, and p-value) for anxiety, depression and stress (from 0 to 42), for the entire sample.

DASS Survey	Pre-MBSR (S1)		Peri-MBSR (S2)			Post-MBSR (S3)			Follow-up MBSR (S4)		
	Mean	SD	Mean	SD	*p(S1-S2)*	Mean	SD	*p(S1-S3)*	Mean	SD	*p(S1-S4)*
Anxiety	10.3	± 1.5	6.8	± 0.9	< 0.01	3.5	± 0.7	< 0.001	6.2	± 1.5	< 0.01
Depression	10.4	± 1.7	7.6	± 1.2	0.07	5.1	± 1.0	< 0.001	7.4	± 1.6	< 0.05
Stress	19.6	± 1.3	15.8	± 1.2	< 0.05	9.4	± 1.3	< 0.001	12.9	± 2.1	< 0.001

3.1 DASS Survey

When considering the global sample, the DASS survey revealed a general improvement in all assessment parameters. The average state of depression dropped from the first session to the following from a qualitative grade of "Medium" to "Normal". Anxiety also exhibited the same pattern being reduced from "Moderate" to "Normal". Self-reported stress also decreased between the first and second sessions from "Moderate" to "Medium" and then to "Normal" in the remaining two sessions. These findings indicate that the Mindfulness course does influence the parameters measured in the DASS survey (Figure 2). In Table 4 we present separate results for anxiety, depression, and stress, as well as the p-values obtained when data from session 1 was compared with data from the other 3 sessions. It is worth noting that only one contrast did not reach statistically significant, i.e., $p \geq 0.05$ (Depression: session 1 against session 2). Since DASS included both qualitative and quantitative discrimination (Figure 1), it allowed the creation of two subgroups of participants, one with low ("Normal" or "Medium") and the other with high levels ("Moderate", "Severe" or "Extremely severe"). The overall results obtained indicate the existence of 14 subjects with "Moderate" to "Extremely Severe" levels of anxiety, 7 with depression and 14 with stress (Table 5). Comparing the first (Pre-MBSR) with the third session (Post-MBSR), 12 out of 14 (85.7%) subjects lowered their anxiety state to "Normal" or

Table 5: Evaluation of Anxiety, Depression and Stress using DASS data in subjects who presented high levels of these conditions in the first session.

State	Condition	Pre-MBSR (S1)	Peri-MBSR (S2)	Post-MBSR (S3)	Follow-up MBSR (S4)
Anxiety	≥10	14	9	2	4
Depression	≥ 14	7	5	2	4
Stress	≥ 19	14	6	1	6

"Medium". The same pattern was observed for depression in 5 out of 7 (71.4%) subjects and for stress in 13 out of 14 subjects (92.9%). This indicates that post-training changes were enhanced in participants who presented more extreme anxiety and stress scores in the baseline assessment. Considering the results in a globally, at the end of MBSR course, 92% of participants (25) reported "Normal" or "Medium" levels of anxiety, 92% of depression and 96% of stress.

3.2 POMS Survey

The POMS states are evaluated with a score ranging from 0 to 4. The tension, hostility, vigor, fatigue and depression are calculated considering the sum of 6 questions each, being 0 to 24 the possible range obtained for each state. The depression score is obtained based on 12 questions varying from 0 to 48.
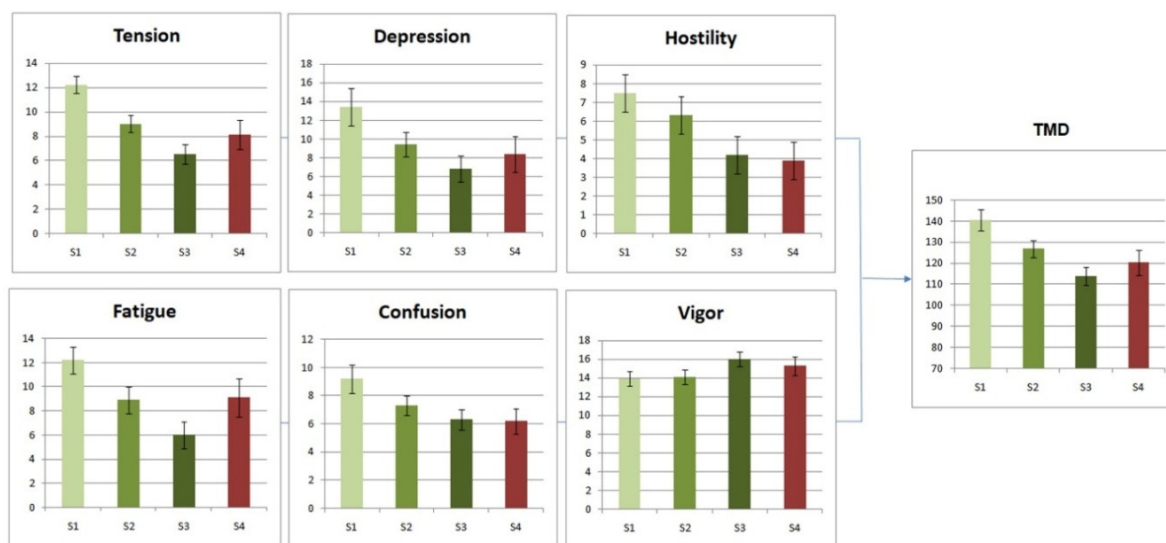
Figure 3: POMS survey averaged results for Tension, Hostility, Fatigue, Confusion, Vigor (from 0 to 24), Depression (from 0 to 48) and TMD (from 76 to 244). The error bars represent the standard deviation.

Table 6: POMS survey results (mean; standard deviation, SD, and p-value) for Tension, Depression, Hostility, Fatigue, Confusion, Vigor and Total Mood Disturbance for the global sample.

POMS Survey	Pre-MBSR (S1)		Peri-MBSR (S2)			Post-MBSR (S3)			Follow-up MBSR (S4)		
	Mean	SD	Mean	SD	$p(S1\text{-}S2)$	Mean	SD	$p(S1\text{-}S3)$	Mean	SD	$p(S1\text{-}S4)$
Tension	12.2	± 0.7	9.0	± 0.7	<0.001	6.5	± 0.8	< 0.001	8.1	± 1.2	< 0.001
Depression	13.4	± 2.0	9.4	± 1.3	< 0.01	6.8	± 1.4	< 0.001	8.4	± 1.9	< 0.001
Hostility	7.5	± 0.7	6.3	± 0.8	0.18	4.2	± 0.7	< 0.001	3.9	± 0.8	< 0.001
Fatigue	12.2	± 1.1	8.9	± 1.1	< 0.01	6.0	± 1.1	< 0.001	9.1	± 1.6	< 0.01
Confusion	9.2	± 1.0	7.3	± 0.7	< 0.01	6.3	± 0.7	< 0.001	6.2	± 0.9	< 0.001
Vigor	13.9	± 0.8	14.1	± 0.8	0.78	16.0	± 0.8	< 0.05	15.3	± 1.0	0.06
TMD	140.6	± 5.0	126.8	± 4.1	< 0.01	113.9	± 4.4	< 0.001	120.3	± 5.9	< 0.001

Considering the global sample, the results comparison from Pre-MBSR to Post-MBSR sessions revealed an increase in the vigor level (15.1%) and an expressive reduction in the remaining states: Tension -46.7%, Depression -49.3%, Hostility -44.0%, Fatigue -50.8% and Confusion -31.5% (Figure 3). This changing pattern was also verified in the intermediate stage of the MBRS course from the first to the second session. The comparison of the third session with the fourth session revealed a general reduction trend in negative mood states (Table 6 and Figure 3). Finally, the comparison of the TMD index from the Pre-MBSR to Post-MBSR session showed a reduction of -19.0%. We also performed a global statistical analysis similar to the one described for the DASS survey. When comparing each session with the first one (Table 6) only three contrasts did not reach statistical significance, i.e. hostility from the first to

the second session and vigor from the first to the second and fourth session.

3.3 WHOQOL-100 Survey

The WHOQOL-100 survey comprises 100 questions ranging from 1 to 5. Each evaluation is performed through 4 answers, with five levels each, resulting in a minimum value of 4 and a maximum value of 20. Compared to previous surveys, the scale interpretation must be reversed, that is, the quality of life is considered higher as the value increases. Regarding the analysis of individual states (Table 7 and Figure 4) an improvement from the Pre-MBSR to the Post-MBSR was observed at all levels: Physical (15.8%), Psychological (15.7%); Independence (15.2%), Social Relationships (9.9%), Environment (9.4%), and Spirituality (9.6%). The final state Quality-of-Life that integrates all previous ones
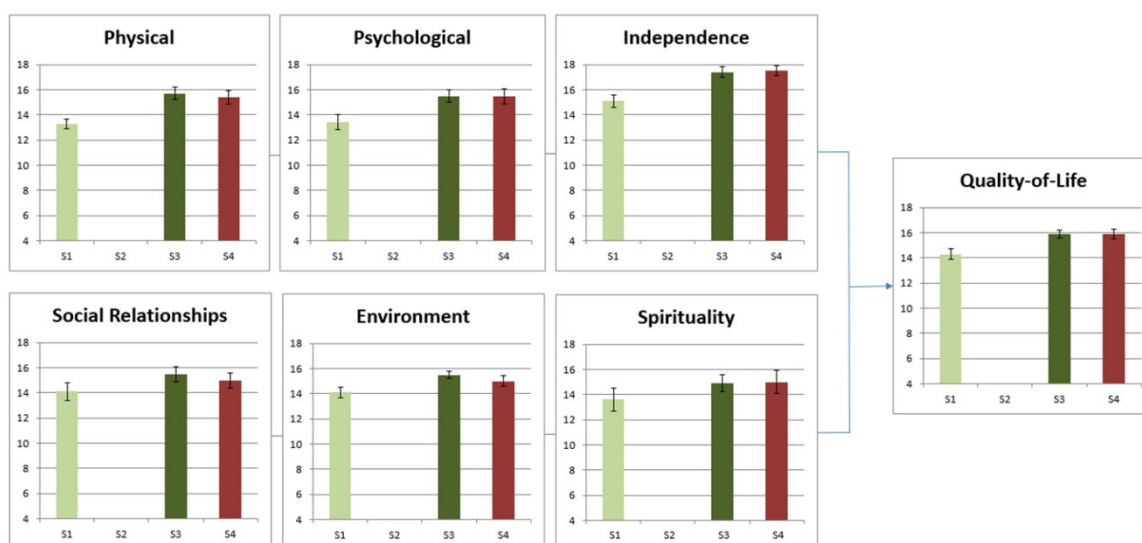
Figure 4: WHOQOL-100 survey averaged results for physical, psychological, independence, social relationships, environment, spirituality and quality-of-life items (from 4 to 20). The error bars represent the standard deviation.

Table 7: WHOQOL survey results (mean; standard deviation, SD, and p-value) for physical, psychology, independence, social relationships, environment and spirituality items, in the global sample.

WHOQOL-100 Survey	Pre-MBSR (S1)		Post-MBSR (S3)			Follow-up MBSR (S4)		
	Mean	SD	Mean	SD	$p(S1\text{-}S3)$	Mean	SD	$p(S1\text{-}S4)$
Physical	13.3	± 0.4	15.7	± 0.5	< 0.001	15.4	± 0.5	< 0.001
Psychological	13.4	± 0.6	15.5	± 0.5	< 0.001	15.5	± 0.6	< 0.001
Independence	15.1	± 0.5	17.4	± 0.4	< 0.001	17.5	± 0.4	< 0.001
Social Relationships	14.1	± 0.7	15.5	± 0.6	< 0.05	15.0	± 0.6	0.06
Environment	14.9	± 0.4	16.3	± 0.3	< 0.001	16.1	± 0.4	< 0.001
Spirituality	13.6	± 0.9	14.9	± 0.7	< 0.05	15.0	± 0.9	< 0.05
Quality-of-Life	14.3	± 0.4	15.9	± 0.3	< 0.001	15.9	± 0.4	< 0.001

presented, in average, an increase of 11.2%. A linear fixed-effects model revealed a global states p<0.05. When comparing each session with the first one (Table 7), only one did not reach statistical significance ('social relationships'; S4; p>0.05).

4 CONCLUSIONS

The results presented in the previous section shed light on the temporal changes of mood and quality of life parameters in participants enrolled in Mindfulness meditation practice. An 11.2% in an individual's Quality-of-Life was observed before and after training. Furthermore, meditation practice was associated with a decrease in the state of anxiety (-66.0%), depression (-51.0%) and TMD (-19.0%). Finally, stress also presented a significant reduction post-practice, i.e., -52.0% (Table 8; Figure 5). This

longitudinal, randomized and actively controlled study has been carried along for 18 weeks, showing a gradual change between sessions. Regarding the fourth session, which took place two months after the end of the course, participants presented a trend of regression to values close to the second session. These results point to functional changes that regress when the subjects stop the practice of this meditation technique. This indicates the benefits of continued Mindfulness meditation as an effective method for mind calming, improving quality of life and increasing positive emotional states. It should be noted that the sample is mainly composed of university students who experienced an increased overload in the second evaluation of July, a period of academic evaluations (Table 3). Nonetheless, even in this stressful moment, the results revealed an evident improvement in the subject's well-being. Given this limitation, it is likely that the results of the third

session are even more relevant to the individual's well-being. Together, the findings of the current study suggest that the daily practice of Mindfulness meditation contributes to reducing depression, anxiety, stress, TMD, and to increase QoL. Mindfulness meditation benefits well-being, potentially preventing clinical mood disturbances that affect a large part of the population.

Table 8: Survey resume evolution of Quality-of-life, Anxiety, Depression, Stress and TMD.

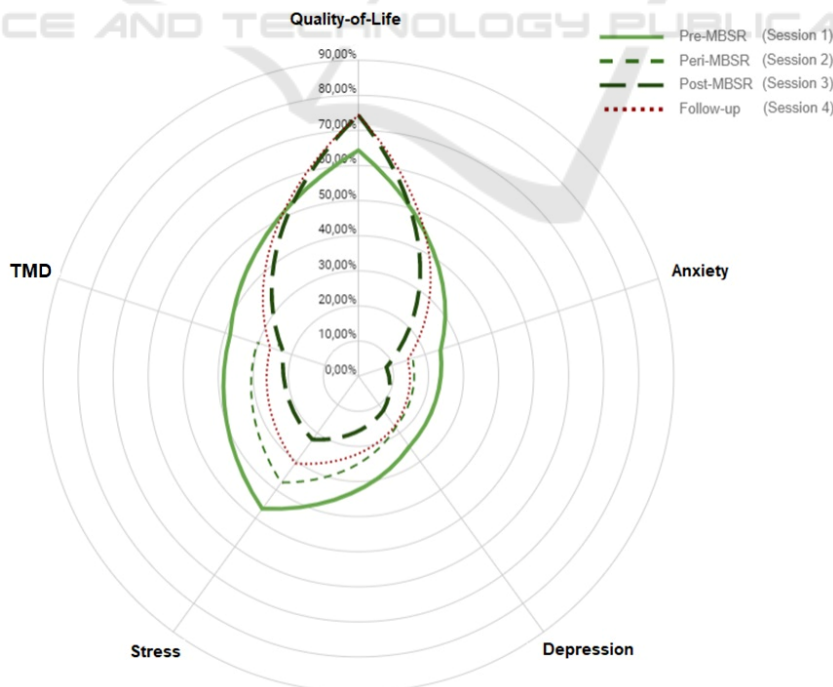| State	Survey	Pre-MBSR (S1)	Peri-MBSR (S2)	Post-MBSR (S3)	Follow-up MBSR (S4)
QoL	WHOQOL	64.4	n.a.	74.4	74.4
Anxiety		24.5	16.2	8.3	14.8
Depression	DASS	24.8	18.1	12.1	17.6
Stress		46.7	37.6	22.4	30.7
TMD	POMS	38.5	30.2	22.6	26.4

DECLARATIONS

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Figure 5: Final states evolution in radar graph for Anxiety, Depression, Stress, TMD and QoL.

REFERENCES

Anheyer, D., Haller, H., Barth, J., Lauche, R., Dobos, G., & Cramer, H. (2017). Mindfulness-based stress reduction for treating low back pain: A systematic review and meta-analysis. In *Annals of Internal Medicine* (Vol. 166, Issue 11, pp. 799–807). American College of Physicians. https://doi.org/10.7326/M16-1997

Chang, S. J., Kwak, E. Y., Hahm, B. J., Seo, S. H., Lee, D. W., & Jang, S. J. (2016). Effects of a Meditation Program on Nurses' Power and Quality of Life. *Nursing Science Quarterly*, *29*(3), 227–234. https://doi.org/10.1177/0894318416647778

de Bruin, E. I., Meppelink, R., & Bögels, S. M. (2015). Mindfulness in Higher Education: Awareness and Attention in University Students Increase During and After Participation in a Mindfulness Curriculum Course. *Mindfulness*, *6*(5), 1137–1142. https://doi.org/10.1007/s12671-014-0364-5

de Vibe, M., Bjørndal, A., Fattah, S., Dyrdal, G. M., Halland, E., & Tanner-Smith, E. E. (2017). Mindfulness-based stress reduction (MBSR) for improving health, quality of life and social functioning in adults: a systematic review and meta-analysis. *Campbell Systematic Reviews*, *13*(1), 1–264. https://doi.org/10.4073/csr.2017.11

Dobkin, P. L., & Hutchinson, T. A. (2013). Teaching mindfulness in medical school: Where are we now and where are we going? *Medical Education*, *47*(8), 768–779. https://doi.org/10.1111/medu.12200

Education, D., Health and Social Care, D., The Rt Hon Damian Hinds, M., & The Rt Hon Matt Hancock, M. (n.d.). *One of the largest mental health trials launches in schools - GOV.UK*. Retrieved April 10, 2019, from https://www.gov.uk/government/news/one-of-the-largest-mental-health-trials-launches-in-schools

Evans, S., Wyka, K., Blaha, K. T., & Allen, E. S. (2018). Self-Compassion Mediates Improvement in Well-being in a Mindfulness-Based Stress Reduction Program in a Community-Based Sample. *Mindfulness*, *9*(4), 1280–1287. https://doi.org/10.1007/s12671-017-0872-1

Faro Viana, M., Almeida, P., & Santos, R. C. (2012). Adaptação portuguesa da versão reduzida do Perfil de Estados de Humor – POMS. *Análise Psicológica*, *19*(1). https://doi.org/10.14417/ap.345

Galante, J., Dufour, G., Benton, A., Howarth, E., Vainre, M., Croudace, T. J., Wagner, A. P., Stochl, J., & Jones, P. B. (2016). Protocol for the Mindful Student Study: A randomised controlled trial of the provision of a mindfulness intervention to support university students' well-being and resilience to stress. *BMJ Open*, *6*(11). https://doi.org/10.1136/bmjopen-2016-012300

Galante, J., Dufour, G., Vainre, M., Wagner, A. P., Stochl, J., Benton, A., Lathia, N., Howarth, E., & Jones, P. B. (2018). A mindfulness-based intervention to increase resilience to stress in university students (the Mindful Student Study): a pragmatic randomised controlled trial. *The Lancet Public Health*, *3*(2), e72–e81. https://doi.org/10.1016/S2468-2667(17)30231-1

Garland, S. N., Carlson, L. E., Cook, S., Lansdell, L., & Speca, M. (2007). A non-randomized comparison of mindfulness-based stress reduction and healing arts programs for facilitating post-traumatic growth and spirituality in cancer outpatients. *Supportive Care in Cancer*, *15*(8), 949–961. https://doi.org/10.1007/s00520-007-0280-5

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*, *57*(1), 35–43. https://doi.org/10.1016/S0022-3999(03)00573-7

Hilton, L., Hempel, S., Ewing, B. A., Apaydin, E., Xenakis, L., Newberry, S., Colaiaco, B., Maher, A. R., Shanman, R. M., Sorbero, M. E., & Maglione, M. A. (2017). Mindfulness Meditation for Chronic Pain: Systematic Review and Meta-analysis. *Annals of Behavioral Medicine*, *51*(2), 199–213. https://doi.org/10.1007/s12160-016-9844-2

João Carvalho das Neves, João Pargana, M. L. (2019). *Leadership Development & Mindfulness - ISEG*. https://www.idefe.pt/cursos/LDM

Kemper, K. J., Carmin, C., Mehta, B., & Binkley, P. (2016). Integrative Medical Care Plus Mindfulness Training for Patients With Congestive Heart Failure. *Journal of Evidence-Based Complementary & Alternative Medicine*, *21*(4), 282–290. https://doi.org/10.1177/2156587215599470

Kolahkaj, B., & Zargar, F. (2015). Effect of Mindfulness-Based Stress Reduction on Anxiety, Depression and Stress in Women With Multiple Sclerosis. *Nursing and Midwifery Studies*, *4*(4). https://doi.org/10.17795/nmsjournal29655

Li, W., Howard, M. O., Garland, E. L., McGovern, P., & Lazar, M. (2017). Mindfulness treatment for substance misuse: A systematic review and meta-analysis. *Journal of Substance Abuse Treatment*, *75*, 62–96. https://doi.org/10.1016/j.jsat.2017.01.008

Manh Dang, J., Bashmi, L., Meeneghan, S., White, J., Hedrick, R., Djurovic, J., Vanle, B., Nguyen, D., Almendarez, J., Ravets, P., Gohar, Y., Hanna, S., Danovitch, I., & William IsHak, W. (2018). The Efficacy of Mindfulness-Based Interventions on Depressive Symptoms and Quality of Life: A Systematic Review of Randomized Controlled Trials. *OBM Integrative and Complementary Medicine*, *3*(2), 1–1. https://doi.org/10.21926/obm.icm.1802011

MathWorks. (2020). *Fit linear mixed-effects model - MATLAB (FITLME)*. https://www.mathworks.com/help/stats/fitlme.html

McConville, J., McAleer, R., & Hahne, A. (2017). Mindfulness Training for Health Profession Students— The Effect of Mindfulness Training on Psychological Well-Being, Learning and Clinical Performance of Health Professional Students: A Systematic Review of Randomized and Non-randomized Controlled Trials. In *Explore: The Journal of Science and Healing* (Vol. 13, Issue 1, pp. 26–45). Elsevier Inc. https://doi.org/10.1016/j.explore.2016.10.002

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). Profile of Mood States (POMS). In *Educational and Industrial Testing Services*. https://doi.org/10.1007/978-1-4419-9893-4_68

Mouzinho, L., Costa, N., Alves, T., Silva, S., & de Lima, L. (2018). Mindfulness Conributions on Medical Conditions: A Literature Review. *Psicologia, Saúde & Doenças*, *19*(2), 182–196. https://doi.org/10.15309/18psd190202

OECD. (2018). *Health at a Glance: Europe 2018*. https://www.oecd.org/health/health-systems/OECD-Factsheet-Mental-Health-Health-at-a-Glance-Europe-2018.pdf

Pais-Ribeiro, J. L., Honrado, A., & Leal, I. (2004). Contribuição para o estudo da adaptação portuguesa das escalas de ansiedade,depressão e stress (eads) de 21 itens de lovibond e lovibond. In *Psicologia, Saúde e Doenças: Vol. V* (Issue 2).

Spijkerman, M. P. J., Pots, W. T. M., & Bohlmeijer, E. T. (2016). Effectiveness of online mindfulness-based interventions in improving mental health: A review and meta-analysis of randomised controlled trials. In *Clinical Psychology Review* (Vol. 45, pp. 102–114). Elsevier Inc. https://doi.org/10.1016/j.cpr.2016.03.009

Tang, Y.-Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Publishing Group*, *16*. https://doi.org/10.1038/nrn3916

Virgili, M. (2015). Mindfulness-Based Interventions Reduce Psychological Distress in Working Adults: a Meta-Analysis of Intervention Studies. *Mindfulness*, *6*(2), 326–337. https://doi.org/10.1007/s12671-013-0264-0

Vos, J., & Vitali, D. (2018). The effects of psychological meaning-centered therapies on quality of life and psychological stress: A metaanalysis. *Palliative & Supportive Care*, *16*(5), 608–632. https://doi.org/10.1017/S1478951517000931

Weare, K. (2018). The Evidence for Mindfulness in Schools for Children and Young People. *The Mindfulness In Schools Project*, *July*, 1–36. https://bit.ly/2X11grY

World Health Organization. (1998). WHOQOL: measuring quality of life. *Psychol Med*, *28*(3), 551–558. https://doi.org/10.5.12

World Health Organization. (2014). *Basic Documents - Constitution of WHO*. http://apps.who.int/gb/bd