Mindfulness Online: A Preliminary Evaluation of the Impact of a Web-based Mindfulness Course on Stress

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MINDFULNESS ONLINE: A PRELIMINARY EVALUATION OF THE IMPACT OF A WEB-BASED MINDFULNESS COURSE ON STRESS

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ARTICLE SUMMARY

Article Focus

- Stress maintained over time can cause a number of negative effects, both physically and psychologically
- Mindfulness interventions have been shown to have significant beneficial effects to health including significantly decreasing stress
- Research Question: Is an online mindfulness course a feasible way to provide an intervention and decrease perceived stress?

Key Messages

- An online mindfulness course does significantly decrease perceived stress
- The decrease in stress is maintained at one month follow-up and is comparable to other interventions
- The online mindfulness course is an accessible and acceptable way for people to receive an intervention which can offer a way to decrease levels of perceived stress

Strengths & Limitations

- Study participants were volunteers to the mindfulness website and this enables us to see how the course benefits the people who are using it
- The effect of practice on trait mindfulness was not examined so it is unclear what mediates the change in perceived stress
- Other factors contributing to a decrease in stress were not included in this preliminary evaluation

ABSTRACT

Objectives: Stress has been shown to have a number of negative effects on health over time. Mindfulness interventions have been shown to decrease perceived stress but access to interventions is limited. Therefore, the effectiveness of an online mindfulness course for perceived stress was investigated.

Design: A preliminary evaluation of an online mindfulness course.

Participants: Our sample consisted of 100 self-referrals to the online course. The average age of participants was 48 years and 74% were female.

Interventions: The online program consisted of modules taken from Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT) and lasted for approximately six weeks

Primary and Secondary Outcome Measures: Participants completed the Perceived Stress Scale (PSS) before the course, after the course, and at one month follow-up. Completion of formal (e.g. body scan, mindful movement) and informal (e.g. mindful meal, noticing) mindfulness activities were self-reported each week.

Results: Participation in the online mindfulness course significantly reduced perceived stress upon completion and remained stable at follow-up. The pre-post effect size was equivalent to levels found in other class-based mindfulness programs. Further, people who had higher PSS scores before the course reported engaging in significantly more mindfulness practice, which was in turn associated with greater decreases in PSS.

Conclusions: Because perceived stress significantly decreased with such limited exposure to mindfulness, there are implications for the accessibility of mindfulness therapies online. Future research needs to evaluate the course effectiveness not only for perceived stress, but also other health benefits for which face-to-face mindfulness therapies have been shown to help, such as anxiety and depressive symptoms.

INTRODUCTION

Stress and worrying thoughts maintained over a prolonged period of time can have a number of negative effects on physical and mental health [1-4]. There is a growing body of evidence demonstrating that a Mindfulness course, be that Mindfulness Based Stress Reduction (MBSR) [5, 6] or Mindfulness Based Cognitive Therapy (MBCT) [7] can be an effective intervention for a broad range of chronic health problems such as depression, chronic pain, anxiety disorders and stress, and that they enhance the level of coping in everyday life [8, 9]. Research also shows that perceived stress decreases after taking part in a Mindfulness intervention, and these benefits are maintained at follow-up; between one and three months [10-12].

As the awareness of the benefits of mindfulness therapy grows, so too does the need for access to this type of intervention. It has been noted that in the UK the NHS cannot handle all of the need for mental health resources [13]. One way to increase access to therapies which is becoming more popular is to create online courses. The benefits of any online therapy, in addition to the reduction in cost to the participant and health service, is the provision for the participant to do the therapy from their own home or other comfortable surroundings and in their own time. Yet perhaps the most important benefit of an effective online intervention, is *accessibility* for a large number of people who may benefit from mindfulness and maybe unable to attend another course for various reasons [14, 15].

There are reasons to believe that such an on-line approach might be appropriate: The results from several trials of online cognitive behavioural therapy for a range of disorders, such as depression, are promising, reporting reduced rates of relapse and appearing to be particularly helpful for prevention of future recurrence and reduction in antidepressant usage [16, 17]. Similar results have been reported for *Beating the Blues*, with significant improvements for anxiety and depression, with increased cost effectiveness than face-to-face Cognitive Behavioural Therapies [18].

However, there are additional challenges for an on-line mindfulness course. This derives from the fact that mindfulness is normally taught in a group or class, and the developers of

mindfulness-based interventions [6, 7] suggest that the presence of others is an important part of the learning. Not only do they provide social support in the form of other participants who can share their experiences of symptoms and the meditation exercises, but participants learn much from the investigative dialogue between teacher and class participants after each mindfulness practice. It is therefore questionable whether on-line mindfulness teaching will prove useful at all.

In this study, therefore, we wished to investigate whether an online mindfulness course has a significant positive effect on the self-reported stress ratings of participants and whether the online course produces similar benefits as the mindfulness courses delivered face-to-face in groups as measured by Perceived Stress Scale (PSS, [19, 20] see Appendix A. for a breakdown of previous research examining changes in PSS scores). In addition, we also examined whether home practice is related to any reduction in stress.

Our hypotheses are that
1. Participants will report significantly lower PSS scores on completion of the online course in comparison to their pre-course PSS score;
2. Participants will rate their PSS scores as significantly lower at one month follow-up compared to their PSS scores taken before the course;
3. Participants who practice more throughout the course will have a larger decrease in their PSS scores; and
4. That the decreases found in the PSS scores will be comparable to other interventions.

METHOD

Participants

Study participants were self-referrals to an online mindfulness course. Participation in the online course was on a self-pay basis. Self-report data were collected prior to the start of the course and there was an opportunity to give feedback one month after course completion.

Procedure

The online intervention was a modified mindfulness course comprising elements of Mindfulness Based Stress Reduction (MBSR) and Mindfulness based Cognitive Therapy (MBCT). The online course costs £40 (~$60US), and follows the same class sequence as the eight week mindfulness course. The course is run by the Mental Health Foundation and Wellmind Media and was developed in conjunction with leading UK mindfulness instructors. The participants access instructional videos which guide the formal meditations, through the website (www.bemindfulonline.co.uk).

The online course consists of ten interactive sessions led by two mindfulness instructors, one male and one female. Participants learn to use formal meditation skills (body scan, mindful movement, sitting meditation, three minute breathing space) and informal mindfulness techniques (incorporating mindfulness into daily activities, such as mindful eating) through

assignments and emails. The course lasts for a minimum of four weeks, depending on when participants are able to complete the practice and homework logs. Participants are able to have a break from the course and receive email reminders to continue at the point that they last participated.

For each week, participants are asked to practice at least one formal exercise using the audio and video clips supplied, such as the body scan, and one informal exercise in their own time, such as eating a meal mindfully. Home practice data are derived from self-report questions enquiring how often the participant had been able to complete certain mindfulness activities during the week.

Measures

The Perceived Stress Scale (PSS; [19] is a widely used and validated scale which measures how much the individual perceives events as uncontrollable and overwhelming during the previous month. The PSS consists of ten items answered using five point scales, each ranging from 0-4, with 4 being the highest stress score. The predictive validity is expected to change after four to eight weeks because of the varying nature of life events and daily worries and their effect on perceived stress. PSS has been used in previous research of mindfulness and has repeatedly shown a reduction in PSS scores using a mindfulness intervention [10-12]. In this study, Perceived Stress ratings were assessed before the intervention, immediately after completing the final practice log and at one month follow-up.

RESULTS

Sample characteristics

Data from the first one hundred participants who completed the course, including the one month follow-up, were analysed. The mean age of the participants was 48 years (SD=11.25, range 28–72), and 74% were female. The mean PSS score for the sample was higher than that provided as the norm distribution which is between 11.9 and 14.7 [20]. The average PSS score of this sample was comparable to previous samples of either “highly stressed” individuals [21] or individuals with a wide range of illness, personal or employment related stress [10].

The average time to finish the course was 6.14 weeks. Participants who did not report their practice were assumed not to have completed any meditation exercises for that week. A majority (90%) answered all of the self-report practice questions; the rest answered at least 8 questions out of 12 except one participant who completed only the first 3, for which we assumed no practice for the remainder of the course. Seven of the ten participants who did not finish all of their practice logs were male but there were no significant differences in age, time taken to complete the course, or PSS scores at any time point between those who practiced and those who did not.

Changes in perceived stress

The changes in mean PSS before and after the course and after one month follow-up are shown in Figure 1. The mean PSS score of the sample prior to the course was 23.73 (SD=9.95, range 10–38). The mean PSS score after MBCT was 14.44 (SD= 5.86, range 1–30), and after one month 13.30 (SD 6.40, range 0–29). Mean PSS score changes significantly from before to after the course ($F(2, 98) = 138.7$, $p<0.001$) and remained stable at one month follow-up. The pre-post effect size (d) was 1.57, comparable to other published studies of mindfulness courses in groups (see Appendix).

Mindfulness practice

The sample was divided into three groups according to the amount of practice: high ("every day or most days" N=33), medium ("sometimes" N=55) and low ("rarely" N=12). There was no significant difference between the practice groups in their PSS score decrease; however, the group reporting the highest amount of practice had the highest stress score before the course ($F(2, 97) = 143.4$, $p<0.001$).

To investigate this trend further, the sample was split into two groups: people who practiced, on average, every day or almost every day (N=33) and people who practiced less (N=67). As before, the people who practiced more were more stressed to begin with ($F(1, 98) = 203.3$, $p<0.001$). Again, there was no significant difference between the practice groups in terms of their PSS score decrease after the course and also at one month follow-up.

DISCUSSION

The aim of this preliminary study was to evaluate the effectiveness of the online mindfulness course for perceived stress. As predicted, we found that participant's PSS scores significantly improved after completing the course and that their scores remain stable at one month follow-up. The hypothesis that participants who practiced more of the formal and informal mindfulness activities would experience a greater decrease in perceived stress was not supported, but led us to find that participants who were more stressed at the outset practiced more and their PSS scores decreased to match the remainder of the sample at the one month follow-up. We found a trend in the expected direction for the amount of mindfulness practice improving PSS scores but this was not significant.

Examining changes in the PSS scores, we found that the online course was comparable to other interventions (see appendix A for a table outlining the change in PSS found in other studies), especially face-to-face MBSR and cognitive therapy courses which reported effects sizes *lower* than those found in this study (ranging from 0.52 to 1.19). However, our online course did not achieve an effect size as high as those found in psychopharmacological treatment research with clinical samples (ranging between 1.59 and 2.34), though we note that these samples start with much higher PSS scores prior to intervention.

The comparability of the online course to other mindfulness and cognitive therapies delivered face-to-face is surprising: the online course seems to achieve as good or slightly better

results. This is despite the fact that people are not part of a group, and have no real relationship with a mindfulness teacher. It is possible that generalisation is helped by the fact that people learn the skills in the very same environment that they then use them, rather than taking time out of their everyday life to attend a mindfulness course in a different context.

It is not unexpected that the online course did not yield as significant a change in PSS as the psychopharmacological studies when considering the difference in samples. The research examining anti-depressants and their effect on perceived stress used clinical samples, usually people with Major Depressive Disorder, who had much higher PSS scores at the outset. One might expect a more significant decrease in PSS, or an improvement in most facets of well-being as participants had more scope for improvement. The sample in this study is made up of a mixture of people with clinical symptoms and without, and is comparable to other trials looking at volunteers from the community, self-reported as 'highly stressed' individuals or having work or illness related stress. Our improvement in PSS is similar to trials using similar samples to our own. There was also no difference in gender or age between those samples and our own.

One limitation of this study is that the effect of practice on trait mindfulness was not examined so it is unclear what mediates the change in perceived stress, something future research needs to include.

A second limitation is the way practice was self-reported by participants. Participants were not asked to state how many minutes they practiced certain exercises, nor for how many days. Instead people self-reported how often they had completed a certain exercise over that week; "every day; most days, once or twice; or never". This may have been problematic for analysis as it may not accurately reflect how many times participants practiced different exercises, for example, we found that the course lasted, on average, six weeks instead of the expected four weeks because people are able to complete the weekly modules in their own time. As such, participants may not have been able to clearly represent how much they were practicing if the amount changed because of a break in the program. It may be useful in future to ask how many days participants practiced each exercise and if the exercise is an informal one, to ask how many times during that day they practiced so that we get a clearer account of what participants did.

Third, there may be many other factors influencing the PSS scores that were not examined in this preliminary study. For example, participants may feel a higher sense of control over their own well-being by taking part in the online program and this may lower perceived stress. Being able to practice (and learn) meditation exercises in locations where one might find the need for them may also reduce perceived stress. One of the benefits of the online course is that participants are able to practice wherever and whenever, be that at home or work; wherever they may feel stressed. Another advantage of investigating online therapy is that every participant receives the same treatment and there is no difference in the way the treatment is delivered, useful in future research examining possible factors mediating the effects.

Fourth, we did not assess clinical status. In future research it would be useful to divide the sample into two groups, a group with clinical symptoms and a group without, to see if there is a difference in the benefits to well-being.

Finally, although only a trend was found in PSS depending on the amount of practice, we did find that people who were more stressed at the beginning practiced more formal and informal mindfulness practices. These participants then made a marked improvement so that at one month follow-up their PSS scores were similar to the rest of the sample. One explanation may be that people who may be feeling more stressed may be more motivated to work to improve than those who are less stressed and therefore put more effort into learning the skills the online course has to offer. Future research should examine this possibility as it bodes well for participants who are more chronic and severe, and warrants further examination of the amount of mindfulness practice in relation to improved well-being in a larger sample.

In conclusion, the results from the preliminary investigation on the effectiveness of online mindfulness therapy look very promising. There is a significant difference in perceived stress before and after the course, and these improvements remain stable. We can conclude that for this first sample, the online mindfulness course does have a large and positive effect on perceived stress. Research of such an accessible and cheap treatment intervention can only be constructive to the health services and to those people who for whatever reason are unable to attend another intervention face-to-face. The effectiveness is comparable to face-to-face group courses, suggesting there may be many modes of delivering effective mindfulness training.

APPENDIX

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the web only version of this paper.

FOOTNOTES

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Contributors: All authors planned the paper, and EC and MW contributed to the first draft, which was written by AK. The intervention was developed by MW, SK, and RL. AK, EC, SK and MW designed the analysis plan, and AK analysed the data. All authors critically revised the manuscript and approved the final version. AK is the guarantor.

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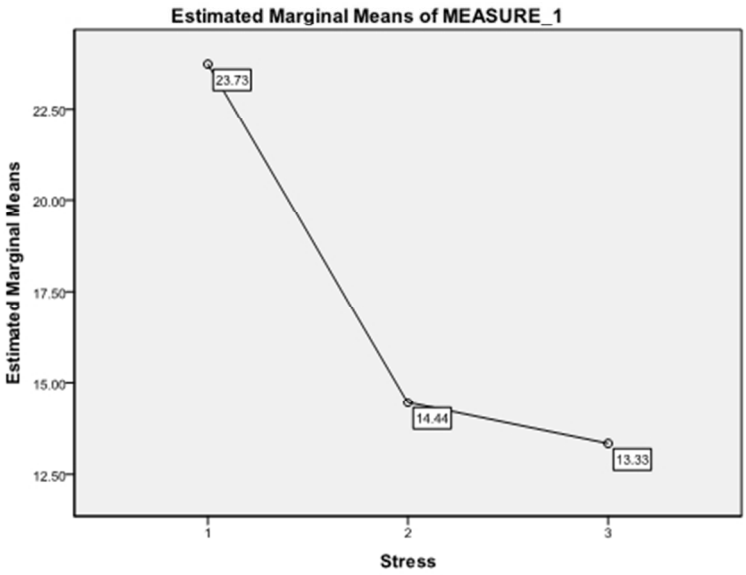
Figure 1. Mean PSS scores before and after course and at one month follow-up (N=100).



Mean PSS scores for the online mindfulness sample
162x107mm (96 x 96 DPI)

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

BeMindfulOnline Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	*Difference*	Pre SD	Post SD	value	effect size (d)	Intervention	Length of Interv.	Delivery
Mindfulness Online: A Preliminary Evaluation of the Impact of a Web-based Mindfulness Course on Stress	BMJ Open	University of Oxford, MHF, Wellmind Media	2012	Non-clinical sample, 74% female	100	23.73	14.44	*9.29*	5.95	5.86	t14.69**	1.57	MBSR/MBCT	4 weeks. Follow-up at post & 1 month	Online

Comparison of BeMindfulOnline and other MBCT/MBSR courses

Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	*Difference*	Pre SD	Post SD	value	d value	Intervention	Length of Interv.	Delivery
An Empirical Study of the Mechanisms of Mindfulness in a Mindfulness-Based Stress Reduction Program [1]	Clin Psych	Carmody, Baer, Lykins & Olendzki	2009	Wide range of problems-illness related stress, chronic pain, anxiety, personal & employment related stress	320/473 consented	20.9	14.59	*6.31*	6.73	5.94	t17.73***	1.02	MBSR	8 sessions over 7 wks	Face to face
The Role of Mindfulness-Based Stress Reduction on Perceived Stress: Preliminary Evidence for the Moderating Role of Attachment Style [2]	Journal of Cognitive Psychotherapy: An International Quarterly	Cordon, Brown & Gibson	2009	Does not state whether clinical sample. Ppts separated into securely-attached & insecurely attached, m age 48, gender 79% female, 96% white	131/185	19.94	14.63	*5.31*	7.15	5.76	f88.77**	0.81	MBSR	8 sessions over 8 weeks	Face to face
Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program [3]	J Behav Med	Carmody & Baer	2008	Wide range of problems-illness related stress, chronic pain, anxiety, personal & employment related stress	174	22.13	15.78	*6.35*	6.19	6.33	t13.14**	1.02	MBSR	8 sessions over 8 weeks	Face to face
Mindfulness-based stress reduction: What processes are at work? [4]	Complementary Therapies in Clinical Practice	Dobkin	2008	Women treated for breast cancer, m age 54	13	20.62	14.46	*6.16*	5.28	5.92	t 3.17**	1.09	MBSR	8 sessions over 8 weeks	Face to face

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

A Pilot Study Comparing the Effects of Mindfulness-Based and Cognitive-Behavioural Stress Reduction [5]	Jnl of Alternative & Complementary Medicine	Smith, Shelley, Dalen, Wiggins, Tooley & Bernard	2008	Recruits from community, av. Age approx. 43, majority female	50 (36)	19.7	14.8	*4.9*	0.69	0.64	f4.990***	0.736	MBSR	8 week course	Face to face
A Pilot Study Comparing the Effects of Mindfulness-Based and Cognitive-Behavioural Stress Reduction [5]	Jnl of Alternative & Complementary Medicine	Smith, Shelley, Dalen, Wiggins, Tooley & Bernard	2008	Recruits from community, av. Age approx. 43, majority female	50 (14)	18.2	13.3	*4.9*	0.87	0.61	f2.875**	0.652	CBSR	8 week course	Face to face
The effects of a mindfulness-based stress reduction program on stress, mindfulness self-efficacy, and positive states of mind [6]	Stress and Health	Chang, Palesh, Caldwell, Glasgow, Abramson, Luskin, Gill, Burke & Koopman	2004	Community volunteers, m age 47, 93% Caucasian, 57.1% women	43	21.4	18.25	*3.15*	6.4	5.72	f7.29*	0.52	MBSR	8 week course	Face to face
Stress reduction correlates with structural changes in the amygdale [7]	Social Cognitive and Affective Neuroscience Advance Access	Holzel, Carmody, Evans, Hoge, Dusek, Morgan, Pitman & Lazar	2009	Community sample, reported high levels of stress during previous months. 41% male, m. age 35.2	27	20.7	15.2	*5.5*	5.6	4.7	f3.7***	1.06	MBSR	8 week course	Face to face
A pilot study of mindfulness-based stress reduction for hot flashes [8]	Jnl of the North American Menopause Society	Carmody, Crawford & Churchill	2006	Women reporting severe hot flashes	15	22	15.5	*6.5*	11.5	8.5	Not reported	0.64	MBSR	7 week course	Face to face
Mindfulness-Based Stress Reduction for Health Care Professionals: Results from a Randomized Trial [9]	International Jnl of Stress Management	Shapiro, Astin, Bishop & Cordova	2005	Health care professionals, e.g. nurses, physicians, social workers, therapists, psychologists, aged 18+	38	26.7	21.1	*5.6*	8.4	6.9	N/A	0.73	MBSR	8 week course	Face to face

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

Comparison of BeMindfulOnline and other treatments/anti-depressants

Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	*Difference*	Pre SD	Post SD	value	d value	Intervention	Length of Interv.	Delivery
Correlations between Perceived Stress and Depressive Symptoms among Depressive Outpatients [10]	Stress Medicine	Fava, Rosenbaum, McCarthy, Pava, Steingard & Fox	1992	MDD Compared to control group	60/102	38.8	25.1	*13.7*	6.4	8.9	t(10.8; p<0.0001	1.76	Fluoxetine	8-12 wks.	N/A
Life Event, Mood, and Cognitive Predictors of Perceived Stress Before and After Treatment for Major Depression. [11]	Cognitive Therapy & Research	Otto, Fava, Penava, Bless, Muller & Rosenbaum	1997	MDD	63	38	25.4	*12.6*	6.1	9.4	t9.9	1.59	Fluoxetine	8 weeks	N/A
Randomised controlled evaluation of the effects of cognitive-behavioural stress management on cortisol responses to acute stress in healthy subjects [12]	Psychoneuroendocrinology	Gaab, Blaater, Menzi, Pabst, Stoyer & Ehlert	2003	Healthy subjects, all male non-smokers. Training either before or after Trier Social Stress Test	48	38.92	N/A	*N/A*	1.41	N/A	Not reported	N/A	Cognitive Behavioural stress management training	2 days	Face to face
Differences in cognitive factors between "true drug" versus "placebo pattern" response to fluoxetine as defined by pattern analysis [13]	Human Psychopharmacology	Farabaugh, Sonawalla, Fava, Pedrelli, Papakostas, Schwartz & Mischoulton	2006	MDD, True drug response	310	36.2	23.5	*12.7*	5.8	7.5	t -0.6*	1.91	Fluoxetine	8 weeks, 20mg/day	N/A
Differences in cognitive factors between "true drug" versus "placebo pattern" response to fluoxetine as defined by pattern analysis [13]	Human Psychopharmacology	Farabaugh, Sonawalla, Fava, Pedrelli, Papakostas, Schwartz & Mischoulton	2006	MDD, placebo pattern response	310	36.8	19	*17.8*	7.7	7.5	t -0.6*	2.34	Fluoxetine	8 weeks, 20mg/day	N/A
Comparison of Three Different Approaches Used in Large-Scale Stress Workshops for the General Public [14]	Behavioural and Cognitive Psychotherapy	Main, Elliot & Brown	2005	General public, 78% female, trial targeting "stressed" individuals, non-clinical sample	12	32.83	25.33	*7.5*	4.9	7.16	f10.47*	1.14	CT	One day, post at 3 month follow-up	Face to face
Comparison of Three Different Approaches Used	Behavioural and	Main, Elliot & Brown	2005	General public, 78% female, trial targeting	13	32.69	28.15	*4.54*	8.1	6.99	f10.47*	0.6	BT	One day, post at 3	Face to face

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

in Large-Scale Stress Workshops for the General Public [14]	Cognitive Psychotherapy			"stressed" individuals, non-clinical sample										month follow-up	
Comparison of Three Different Approaches Used in Large-Scale Stress Workshops for the General Public [14]	Behavioural and Cognitive Psychotherapy	Main, Elliot & Brown	2005	General public, 78% female, trial targeting "stressed" individuals, non-clinical sample	22	36.36	29.86	*6.5*	8.12	7.29	f10.47*	0.84	CBT	One day, post at 3 month follow-up	Face to face
A Randomized Controlled Trial of the Effects of Applied Relaxation Training on Reducing Anxiety and Perceived Stress in Pregnant Women [15]	Jnl of Midwifery & Women's Health	Bastani, Hidarnia, Kazemnejad, Vafaei & Kashanian	2005	Pregnant women, in second trimester, m. age 24, moderate to high anxiety on the Spielberger State/Trait Anxiety Inventory, all married	110	31.29	24.44	*6.85*	5.72	5.84	p<.001	1.19	Applied relaxation. e.g. version of progressive relaxation-tense & release, Ost	7 weeks	Face to face

Dispositional, no intervention

Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	Difference	Pre SD	Post SD	value	d value	Intervention	Length of Interv.	Delivery
A Global Measure of Perceived Stress [16]	J of Health and Social Beh	Cohen, Kamarck & Mermelstein	1983	Students, majority fem, m age 19	332	23.18	N/A		7.31						
A Global Measure of Perceived Stress [16]	J of Health and Social Beh	Cohen, Kamarck & Mermelstein	1983	Students, approx. 50% gender split, m age 20.75	114	23.67	N/A		7.79						
A Global Measure of Perceived Stress [16]	J of Health and Social Beh	Cohen, Kamarck & Mermelstein	1983	Smoking Cessation, cohabiting or married, m age 38.4	64	25	N/A		8						

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

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MINDFULNESS ONLINE: A PRELIMINARY EVALUATION OF THE FEASIBILITY OF A WEB-BASED MINDFULNESS COURSE AND THE IMPACT ON STRESS

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MINDFULNESS ONLINE: A PRELIMINARY EVALUATION OF THE FEASIBILITY ~~IMPACT~~ OF A WEB-BASED MINDFULNESS COURSE AND THE IMPACT ON STRESS

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ARTICLE SUMMARY

Article Focus

- Stress maintained over time can cause a number of negative effects, both physically and psychologically
- Mindfulness interventions have been shown to have significant beneficial effects to health including significantly decreasing stress
- Research Question: Is an online mindfulness course a feasible way to provide an intervention and decrease perceived stress?

Key Messages

- An online mindfulness course ~~does~~ can significantly decrease perceived stress
- The decrease in stress is maintained at one month follow-up and is comparable to other interventions
- The online mindfulness course is an accessible and acceptable way for people to receive an intervention which can offer a way to decrease levels of perceived stress

Strengths & Limitations

- The sample consisted of people who had signed up to and paid for ~~to~~ the online course~~Study participants were volunteers to the mindfulness website~~ which ~~enables us to see how the course benefits the~~limits the extent to which we can extrapolate to those ~~people~~ who ~~are~~ might use it because referred by others (such as a health professional)~~ing it~~
- The effect of practice on ~~trait~~ mindfulness was not examined so it is unclear what mediates the change in perceived stress
- Other factors contributing to a decrease in stress were not included in this preliminary evaluation

ABSTRACT

Objectives: Stress has been shown to have a number of negative effects on health over time. Mindfulness interventions have been shown to decrease perceived stress but access to interventions is limited. Therefore, the effectiveness of an online mindfulness course for perceived stress was investigated.

Design: A preliminary evaluation of an online mindfulness course.

Participants: Our sample consisted of 100 self-referrals to the online course. The average age of participants was 48 years and 74% were female.

Interventions: The online programme consisted of modules taken from Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT) and lasted for approximately six weeks

Primary and Secondary Outcome Measures: Participants completed the Perceived Stress Scale (PSS) before the course, after the course, and at one month follow-up. Completion of formal (e.g. body scan, mindful movement) and informal (e.g. mindful meal, noticing) mindfulness activities were self-reported each week.

Results: Participation in the online mindfulness course significantly reduced perceived stress upon completion and remained stable at follow-up. The pre-post effect size was equivalent to levels found in other class-based mindfulness programs. Further, people who had higher PSS scores before the course reported engaging in significantly more mindfulness practice, which was in turn associated with greater decreases in PSS.

Conclusions: Because perceived stress significantly decreased with such limited exposure to mindfulness, there are implications for the accessibility of mindfulness therapies online. Future research needs to evaluate ~~the course effectiveness not only for perceived stress, but also~~ other health ~~benefits~~ outcomes for which face-to-face mindfulness therapies have been shown to help, such as anxiety and depressive symptoms.

Key Words: Mindfulness, Online Therapy, Perceived Stress, Meditation.

INTRODUCTION

Stress and worrying thoughts maintained over a prolonged period of time can have a number of negative effects on physical and mental health [1-4]. There is a growing body of evidence demonstrating that a Mindfulness course, be that Mindfulness Based Stress Reduction (MBSR) [5, 6] or Mindfulness Based Cognitive Therapy (MBCT) [7] can be an effective intervention for a broad range of chronic health problems such as depression, chronic pain, anxiety disorders and stress, and that they enhance the level of coping in everyday life [8, 9]. Research also shows that perceived stress decreases after taking part in a Mindfulness intervention, and these benefits are maintained at follow-up; between one and three months [10-12].

As the awareness of the benefits of mindfulness therapy grows, so too does the need for access to this type of intervention. It has been noted that in the UK the NHS cannot handle all of the need for mental health resources [13]. One way to increase access to therapies which is becoming more popular is to create online courses. The benefits of any online therapy, in addition to the reduction in cost to the participant and health service, is the provision for the participant to do the therapy from their own home or other comfortable surroundings and in their own time. Yet perhaps the most important benefit of an effective online intervention, is *accessibility* for a large number of people who may benefit from mindfulness and maybe unable to attend another course for various reasons [14, 15].

There are reasons to believe that such an on-line approach might be appropriate: The results from several trials of online cognitive behavioural therapy for a range of disorders~~, such as depression,~~ are promising, reporting reduced rates of depression relapse and appearing to be particularly helpful for prevention of future recurrence and reduction in antidepressant usage [16, 17]. Similar results have been reported for *Beating the Blues*, with significant improvements for anxiety and depression, with increased cost effectiveness than face-to-face Cognitive Behavioural Therapies [18].

However, there are additional challenges for an on-line mindfulness course. This derives from the fact that mindfulness is normally taught in a group or class, and the developers of mindfulness-based interventions [6, 7] suggest that the presence of others is an important part of the learning. Not only do they provide social support in the form of other participants who can share their experiences of symptoms and the meditation exercises, but participants learn much from the investigative dialogue between teacher and class participants after each mindfulness practice. It is therefore questionable whether on-line mindfulness teaching will prove useful at all.

In this study, therefore, we wished to investigate whether an online mindfulness course has a significant positive effect on the self-reported stress ratings of participants and whether the online course produces similar benefits as the mindfulness courses delivered face-to-face in groups as measured by Perceived Stress Scale (PSS, [19, 20] see Appendix A. for a breakdown of previous research examining changes in PSS scores). Stress was decided on as

the outcome measure, ~~primarily~~first, because we wanted to measure something which people could ~~more~~ readily relate to. Second, a number of studies using m~~M~~indfulness-based interventions ~~therapies~~ have ~~been found to~~shown that they reduce stress and have used this measure, so we ~~wanted to investigate whether the same could be said for a~~could 'benchmark' the impact of the online mindfulness course against the existing evidence-base ~~online~~. ~~In addition~~Third, we ~~also~~ wished to examine~~d~~ whether the amount of home practice is related to any reduction in stress.

Our hypotheses are that

1. Participants will report significantly lower PSS scores on completion of the online course in comparison to their pre-course PSS score;
2. ~~Participants will rate their PSS scores as significantly~~The reduction in stress will be maintained ~~lower~~ at one month follow-up compared to their PSS scores taken before the course;
3. Participants who practice more throughout the course will have a larger decrease in their PSS scores; and
4. ~~That~~ the decreases found in the PSS scores will be comparable to other face to face mindfulness interventions.

METHOD

Participants

Study participants were self-referrals to an online mindfulness course. These participants were not recruited for this study specifically and consented for their data to be used anonymously for research upon registering. Participation in the online course was on a self-pay basis. Self-report data were collected prior to the start of the course and there was an opportunity to give feedback one month after course completion.

Procedure

The online intervention was a modified mindfulness course comprising elements of Mindfulness Based Stress Reduction (MBSR) and Mindfulness based Cognitive Therapy (MBCT). The online course costs £40 (~$60US), and follows the same class sequence as the eight week mindfulness course. The course is run by the Mental Health Foundation and Wellmind Media and was developed in conjunction with leading UK mindfulness instructors. The participants access instructional videos which guide the formal meditations, through the website (www.bemindfulonline.co~~.uk~~m).

The online course consists of ten interactive sessions led by two mindfulness instructors, one male and one female. Participants learn to use formal meditation skills (body scan, mindful movement, sitting meditation, three minute breathing space) and informal mindfulness techniques (incorporating mindfulness into daily activities, such as mindful eating) through videos, assignments and emails. The course lasts for a minimum of four weeks, depending on when participants are able to complete the practice and homework logs. Participants are able

to have a break from the course and receive email reminders to continue at the point that they last participated.

For each week, participants are asked to practice at least one formal exercise using the audio and video clips supplied, such as the body scan which lasts for 30 minutes, or mindful movement, lasting ten minutes and one informal exercise in their own time, such as eating a meal mindfully. Home practice data are derived from online self-report questions enquiring how often the participant had been able to complete certain mindfulness activities during the week.

Measures

The Perceived Stress Scale (PSS; [19] is a widely used and validated scale which measures how much the individual perceives events as uncontrollable and overwhelming during the previous month. Validity and reliability of the PSS have been reported as good [19]. Cronbach's alpha in this study was 0.72. The PSS consists of ten items answered using five point scales, each ranging from 0-4, with 4 being the highest stress score. The predictive validity is expected to change after four to eight weeks because of the varying nature of life events and daily worries and their effect on perceived stress. PSS has been used in previous research of mindfulness and has repeatedly shown a reduction in PSS scores using a mindfulness intervention [10-12]. In this study, Perceived Stress ratings were assessed before the intervention, immediately after completing the final practice log and at one month follow-up.

RESULTS

Sample characteristics

Data from the first one hundred participants who completed the course, including the one month follow-up, were analysed. The mean age of the participants was 48 years (SD=11.25, range 28–72), and 74% were female. The mean PSS score for the sample was higher than that provided as the norm distribution which is between 11.9 and 14.7 [20]. The average PSS score of this sample was comparable to previous samples of either "highly stressed" individuals [21] or individuals with a wide range of illness, personal or employment related stress [10].

The average time to finish the course was 6.14 weeks. Participants who did not report their practice were assumed not to have completed any meditation exercises for that week. A majority (90%) answered all of the self-report practice questions; the rest answered at least 8 questions out of 12 except one participant who completed only the first 3, for which we assumed no practice for the remainder of the course. Seven of the ten participants who did not finish all of their practice logs were male but there were no significant differences in age, time taken to complete the course, or PSS scores at any time point between those who practiced and those who did not.

Changes in perceived stress

The changes in mean PSS before and after the course and after one month follow-up are shown in Figure 1. The mean PSS score of the sample prior to the course was 23.73 (SD=9.95, range 10–38). The mean PSS score after MBCT was 14.44 (SD= 5.86, range 1–30), and after one month 13.30 (SD 6.40, range 0–29). Mean PSS score changes significantly from before to after the course ($F(2, 98) = 138.7$, $p<0.001$) and remained stable at one month follow-up. The pre-post effect size (d) was 1.57, comparable to other published studies of mindfulness courses in groups (see Appendix).

Mindfulness practice

The sample was divided into three groups according to the amount of practice: high ("every day or most days" N=33), medium ("sometimes" N=55) and low ("rarely" N=12). There was no significant difference between the practice groups in their PSS score decrease; however, the group reporting the highest amount of practice had the highest stress score before the course ($F(2, 97) = 143.4$, $p<0.001$).

To investigate this trend further, the sample was split into two groups: people who practiced, on average, every day or almost every day (N=33) and people who practiced less (N=67). As before, the people who practiced more were more stressed to begin with ($F(1, 98) = 203.3$, $p<0.001$). Again, there was no significant difference between the practice groups in terms of their PSS score decrease after the course and also at one month follow-up.

DISCUSSION

The aim of this preliminary study was to evaluate the feasibility ~~effectiveness~~ of the online mindfulness course and to gather preliminary evidence on its efficacy ~~the effectiveness for~~on reducing ~~for~~ perceived stress. This initial investigation suggests that people are able to use~~ing~~ the course in this mode of delivery and finding it helpful. As predicted, we found that participant~~'s~~' PSS scores significantly improved after completing the course and that their scores remain stable at one month follow-up. The hypothesis that participants who practiced more of the formal and informal mindfulness activities would experience a greater decrease in perceived stress was not supported, but led us to find that participants who were more stressed at the outset practiced more and their PSS scores decreased to match the remainder of the sample at the one month follow-up. We found a trend in the expected direction for the amount of mindfulness practice improving PSS scores but this was not significant.

As this study is a preliminary investigation, before further discussion it ~~into the usage of the online interventions, there~~is important to take account of ~~are~~ a number of limitations.

First~~ly~~, there was no control comparison so we cannot be sure whether the online course was wholly responsible for the decline in perceived stress. There may have been other variables responsible, or the passage of time alone may result in such a decrease. This ~~will~~clearly needs to be addressed in future research. This is especially important as the group studied were

people who were seeking for the course, and paying a small fee to undertake it. We do not know if it generalizes to other populations, such as NHS patients in the UK, who do not pay for their treatment.

Second, even if the reduction in stress was not due to the enthusiasm of the people taking the course, ~~Some~~we don't know which of -many factors might have influenced~~eing~~ the PSS scores. In particular, the effect of practice on trait mindfulness was not examined so it is unclear even whether it is change in mindfulness that mediates the change in perceived stress. It is possible, for example, that stress is reduced by non-specific factors, such as ~~that were not examined in this preliminary study could include~~ participants feeling a higher sense of control over their own well-being by taking part in the online programme.~~,~~ This aspect will be included in future research. ~~Bbeing able to practice (and learn) meditation exercises in locations where one might find the need for them may also reduce perceived stress.~~

~~One of the benefits of the online course is that participants are able to practice wherever and whenever, be that at home or work; wherever they may feel stressed. Another advantage of investigating online therapy is that every participant receives the same treatment and there is no difference in the way the treatment is delivered, useful in future research examining possible factors mediating the effects.~~

A ~~second~~ third limitation is the way practice was self-reported by participants so we cannot be sure how accurately practice was reported. Participants were not asked to state how many minutes they practiced certain exercises, nor for how many days. Instead people self-reported how often they had completed a certain exercise over that week; "every day; most days~~;~~ once or twice; or never". This may have been problematic for analysis as it may not accurately reflect how many times participants practiced different exercises~~;~~ for example, we found that the course lasted, on average, six weeks instead of the expected four weeks because people are able to complete the weekly modules in their own time. As such, participants may not have been able to clearly represent how much they were practicing if the amount changed because of a break in the program. It may be useful in future to ask how many days participants practiced each exercise and if the exercise is an informal one, to ask how many times during that day they practiced so that we get a clearer account of what participants did.

~~Third, the effect of practice on trait mindfulness was not examined so it is unclear what mediates the change in perceived stress. This aspect will be included in , something future research needs to include.~~

Fourth, we know little about the current sample and ~~we~~ did not assess clinical status. In particular, anxiety and depressive symptoms were not assessed. In future research it would be useful to ~~divide the sample into two groups:~~,see whether a group with clinical symptoms meeting 'caseness' criteria derived benefit, and to what extent, as well as continuing to ~~and a group without, to see if there is a difference in the~~investigate benefits to well-being in the wider population. ~~Anxiety and depressive symptoms were not assessed initially; again, this will be assessed, something intended for in future research.~~

Finally, although only a trend was found in PSS score change depending on the amount of practice, we did find that people who were more stressed at the beginning practiced more formal and informal mindfulness practices. These participants then made a marked improvement so that at one month follow-up their PSS scores were similar to the rest of the sample. One explanation may be that people who aremay be feeling more stressed may be more motivated to worktoand improve and therefore put more effort into learning the skills the online course has to offer than those who are less stressed and therefore put more effort into learning the skills the online course has to offer. However, without a control group it is not possible to rule out the possibility that this finding represents 'regression to the mean' of initial 'outliers'. Future research should examine theseis possibilitiesty as it will clarify whether this programme bodes is useful well even for participants who are report persistent high levels of stressmore chronic and severe., and warrants further examination of the amount of mindfulness practice in relation to improved well-being in a larger sample.

Bearing in mind the outlined studythese limitations, Examining changes in the PSS scores, it is important to note that we found that the changes in the PSS scores following the online coursefound in this study wereas comparable to other interventions (see appendix A for a table outlining the change in PSS found in other studies), especially face-to-face MBSR and cognitive therapy courses which reported effects sizes *lower* than those found in this study (ranging from 0.52 to 1.19). However, our online course did not achieve an effect size as high as those found in psychopharmacological treatment research with clinical samples (ranging between 1.59 and 2.34), though we note that these samples start with much higher PSS scores prior to intervention.

AnThis initial The comparisonabilityapparent comparability of the online course to other mindfulness and cognitive therapies delivered face-to-face is surprising: the online course seems to achieve as good or slightly better similar results. This is despite the fact that people are not part of a group, and have no real relationship with a mindfulness teacher or other participants (often cited as critically important facilitators of change in class-based formats). It is possible that generalisation is helped by the fact that people learn the skills in the very same environment that they then use them, rather than taking time out of their everyday life to attend a mindfulness course in a different context.

It is not unexpected that the online course did not yield as significant a change in PSS as the psychopharmacological studies when considering the difference in samples. The research examining anti-depressants and their effect on perceived stress used clinical samples, usually people with Major Depressive Disorder, who had much higher PSS scores at the outset. One might expect a more significant decrease in PSS, or an improvement in most facets of well-being as participants had more scope for improvement.

Finally, we note that the teachers of this on-line course were experienced meditation practitioners, so we cannot infer from any degree of efficacy found with a shorter

mindfulness-based courses such as this one, that *any* short course delivered by any therapist will thereby be effective.

~~The sample in this study is made up of a mixture of people with and without clinical symptoms and without, and is comparable to other trials looking at volunteers from the community, self-reported as 'highly stressed' individuals or having work or illness related stress. Our improvement in PSS is similar to trials using similar samples to our own. There was also no difference in gender or age between those samples and our own.~~

In conclusion, the results from ~~the~~ our preliminary investigation on the feasibility ~~effectiveness~~ of an online mode for mindfulness-based intervention ~~therapy~~ look ~~very~~ promising. Given that the needs of the general public to find ways of reducing stress are enormous, r~~There is a significant difference in perceived stress before and after the course, and these improvements remain stable. We can conclude that for this first sample, the online mindfulness course does may have a large and positive effect on perceived stress, although further research intends to investigate other possible causes and compare the sample to a control group. The effectiveness thus far is seeminglyappears to be comparable to face-to-face group courses, suggesting there may be many modes of delivering feasible and effective mindfulness training. R~~esearch of such an accessible and cheap treatment intervention, so long as the quality and integrity is assured, can only be constructive to ~~the~~ health services around the world, and to those people who for whatever reason are unable to attend ~~another~~ a ~~intervention face-to-face~~class or therapy.

APPENDIX

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the web only version of this paper.

FOOTNOTES

Acknowledgements: We would like to thank Richard Latham of Wellmind Media Ltd., for his help in developing the online intervention, and Paul Bristow of the Mental Health Foundation, for his continued support.

Contributors: All authors planned the paper, and EC and MW contributed to the first draft, which was written by AK. The intervention was developed by MW, SK, and RL. -AK, EC, SK and MW designed the analysis plan, and AK analysed the data. All authors critically revised the manuscript and approved the final version. AK is the guarantor.

Competing interests: Wellmind Media Ltd. and the Mental Health Foundation receive a fee from the intervention. None of the authors receive any payment personally; there are no other relationships or activities that could appear to have influenced the submitted work. The data wereas handled and analysed securely and confidentially by AK at the University of Oxford.

Consent:

This investigation was conducted as an initial audit of the online mindfulness course for its usefulness. Consent was taken upon registering for the course.

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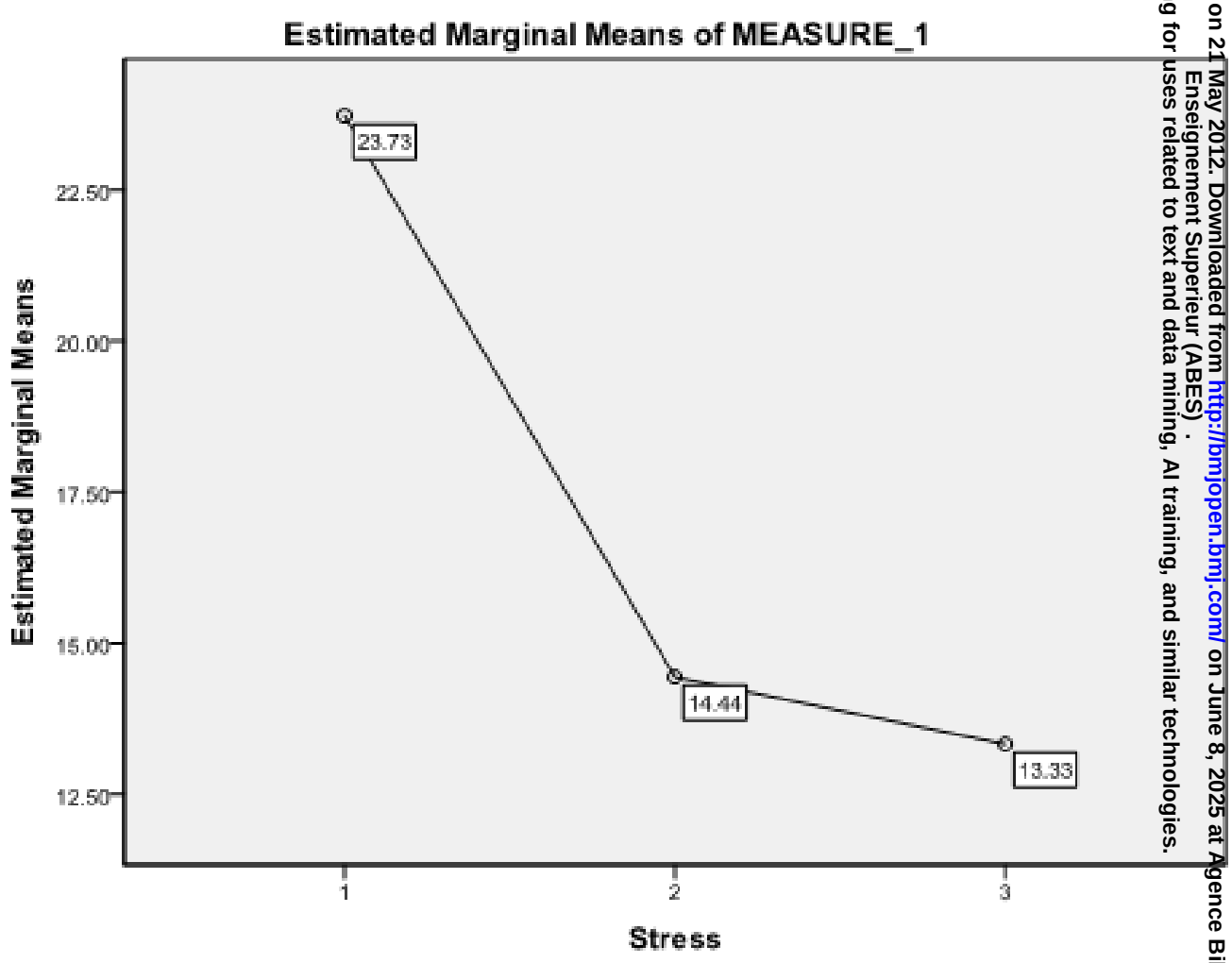
Figure 1. Mean PSS scores before and after course and at one month follow up (N=100).



Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

BeMindfulOnline Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	*Difference*	Pre SD	Post SD	value	effect size (d)	Intervention	Length of Interv.	Delivery
Mindfulness Online: A Preliminary Evaluation of the Impact of a Web-based Mindfulness Course on Stress	BMJ Open	University of Oxford, MHF, Wellmind Media	2012	Non-clinical sample, 74% female	100	23.73	14.44	*9.29*	5.95	5.86	t14.69**	1.57	MBSR/MBCT	4 weeks. Follow-up at post & 1 month	Online

Comparison of BeMindfulOnline and other MBCT/MBSR courses

Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	*Difference*	Pre SD	Post SD	value	d value	Intervention	Length of Interv.	Delivery
An Empirical Study of the Mechanisms of Mindfulness in a Mindfulness-Based Stress Reduction Program [1]	Clin Psych	Carmody, Baer, Lykins & Olendzki	2009	Wide range of problems-illness related stress, chronic pain, anxiety, personal & employment related stress	320/473 consented	20.9	14.59	*6.31*	6.73	5.94	t17.73***	1.02	MBSR	8 sessions over 7 wks	Face to face
The Role of Mindfulness-Based Stress Reduction on Perceived Stress: Preliminary Evidence for the Moderating Role of Attachment Style [2]	Journal of Cognitive Psychotherapy: An International Quarterly	Cordon, Brown & Gibson	2009	Does not state whether clinical sample. Ppts separated into securely-attached & insecurely attached, m age 48, gender 79% female, 96% white	131/185	19.94	14.63	*5.31*	7.15	5.76	f88.77**	0.81	MBSR	8 sessions over 8 weeks	Face to face
Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program [3]	J Behav Med	Carmody & Baer	2008	Wide range of problems-illness related stress, chronic pain, anxiety, personal & employment related stress	174	22.13	15.78	*6.35*	6.19	6.33	t13.14**	1.02	MBSR	8 sessions over 8 weeks	Face to face
Mindfulness-based stress reduction: What processes are at work? [4]	Complementary Therapies in Clinical Practice	Dobkin	2008	Women treated for breast cancer, m age 54	13	20.62	14.46	*6.16*	5.28	5.92	t 3.17**	1.09	MBSR	8 sessions over 8 weeks	Face to face

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

A Pilot Study Comparing the Effects of Mindfulness-Based and Cognitive-Behavioural Stress Reduction [5]	Jnl of Alternative & Complementary Medicine	Smith, Shelley, Dalen, Wiggins, Tooley & Bernard	2008	Recruits from community, av. Age approx. 43, majority female	50 (36)	19.7	14.8	*4.9*	0.69	0.64	f4.990***	0.736	MBSR	8 week course	Face to face
A Pilot Study Comparing the Effects of Mindfulness-Based and Cognitive-Behavioural Stress Reduction [5]	Jnl of Alternative & Complementary Medicine	Smith, Shelley, Dalen, Wiggins, Tooley & Bernard	2008	Recruits from community, av. Age approx. 43, majority female	50 (14)	18.2	13.3	*4.9*	0.87	0.61	f2.875**	0.652	CBSR	8 week course	Face to face
The effects of a mindfulness-based stress reduction program on stress, mindfulness self-efficacy, and positive states of mind [6]	Stress and Health	Chang, Palesh, Caldwell, Glasgow, Abramson, Luskin, Gill, Burke & Koopman	2004	Community volunteers, m age 47, 93% Caucasian, 57.1% women	43	21.4	18.25	*3.15*	6.4	5.72	f7.29*	0.52	MBSR	8 week course	Face to face
Stress reduction correlates with structural changes in the amygdale [7]	Social Cognitive and Affective Neuroscience Advance Access	Holzel, Carmody, Evans, Hoge, Dusek, Morgan, Pitman & Lazar	2009	Community sample, reported high levels of stress during previous months. 41% male, m. age 35.2	27	20.7	15.2	*5.5*	5.6	4.7	f3.7***	1.06	MBSR	8 week course	Face to face
A pilot study of mindfulness-based stress reduction for hot flashes [8]	Jnl of the North American Menopause Society	Carmody, Crawford & Churchill	2006	Women reporting severe hot flashes	15	22	15.5	*6.5*	11.5	8.5	Not reported	0.64	MBSR	7 week course	Face to face
Mindfulness-Based Stress Reduction for Health Care Professionals: Results from a Randomized Trial [9]	International Jnl of Stress Management	Shapiro, Astin, Bishop & Cordova	2005	Health care professionals, e.g. nurses, physicians, social workers, therapists, psychologists, aged 18+	38	26.7	21.1	*5.6*	8.4	6.9	N/A	0.73	MBSR	8 week course	Face to face

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

Comparison of BeMindfulOnline and other treatments/anti-depressants

Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	*Difference*	Pre SD	Post SD	value	d value	Intervention	Length of Interv.	Delivery
Correlations between Perceived Stress and Depressive Symptoms among Depressive Outpatients [10]	Stress Medicine	Fava, Rosenbaum, McCarthy, Pava, Steingard & Fox	1992	MDD Compared to control group	60/102	38.8	25.1	*13.7*	6.4	8.9	t(10.8; p<0.0001	1.76	Fluoxetine	8-12 wks.	N/A
Life Event, Mood, and Cognitive Predictors of Perceived Stress Before and After Treatment for Major Depression. [11]	Cognitive Therapy & Research	Otto, Fava, Penava, Bless, Muller & Rosenbaum	1997	MDD	63	38	25.4	*12.6*	6.1	9.4	t9.9	1.59	Fluoxetine	8 weeks	N/A
Randomised controlled evaluation of the effects of cognitive-behavioural stress management on cortisol responses to acute stress in healthy subjects [12]	Psychoneuroendocrinology	Gaab, Blaater, Menzi, Pabst, Stoyer & Ehlert	2003	Healthy subjects, all male non-smokers. Training either before or after Trier Social Stress Test	48	38.92	N/A	*N/A*	1.41	N/A	Not reported	N/A	Cognitive Behavioural stress management training	2 days	Face to face
Differences in cognitive factors between "true drug" versus "placebo pattern" response to fluoxetine as defined by pattern analysis [13]	Human Psychopharmacology	Farabaugh, Sonawalla, Fava, Pedrelli, Papakostas, Schwartz & Mischoulton	2006	MDD, True drug response	310	36.2	23.5	*12.7*	5.8	7.5	t -0.6*	1.91	Fluoxetine	8 weeks, 20mg/day	N/A
Differences in cognitive factors between "true drug" versus "placebo pattern" response to fluoxetine as defined by pattern analysis [13]	Human Psychopharmacology	Farabaugh, Sonawalla, Fava, Pedrelli, Papakostas, Schwartz & Mischoulton	2006	MDD, placebo pattern response	310	36.8	19	*17.8*	7.7	7.5	t -0.6*	2.34	Fluoxetine	8 weeks, 20mg/day	N/A
Comparison of Three Different Approaches Used in Large-Scale Stress Workshops for the General Public [14]	Behavioural and Cognitive Psychotherapy	Main, Elliot & Brown	2005	General public, 78% female, trial targeting "stressed" individuals, non-clinical sample	12	32.83	25.33	*7.5*	4.9	7.16	f10.47*	1.14	CT	One day, post at 3 month follow-up	Face to face
Comparison of Three Different Approaches Used	Behavioural and	Main, Elliot & Brown	2005	General public, 78% female, trial targeting	13	32.69	28.15	*4.54*	8.1	6.99	f10.47*	0.6	BT	One day, post at 3	Face to face

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

in Large-Scale Stress Workshops for the General Public [14]	Cognitive Psychotherapy			"stressed" individuals, non-clinical sample										month follow-up	
Comparison of Three Different Approaches Used in Large-Scale Stress Workshops for the General Public [14]	Behavioural and Cognitive Psychotherapy	Main, Elliot & Brown	2005	General public, 78% female, trial targeting "stressed" individuals, non-clinical sample	22	36.36	29.86	*6.5*	8.12	7.29	f10.47*	0.84	CBT	One day, post at 3 month follow-up	Face to face
A Randomized Controlled Trial of the Effects of Applied Relaxation Training on Reducing Anxiety and Perceived Stress in Pregnant Women [15]	Jnl of Midwifery & Women's Health	Bastani, Hidarnia, Kazemnejad, Vafaei & Kashanian	2005	Pregnant women, in second trimester, m. age 24, moderate to high anxiety on the Spielberger State/Trait Anxiety Inventory, all married	110	31.29	24.44	*6.85*	5.72	5.84	p<.001	1.19	Applied relaxation. e.g. version of progressive relaxation-tense & release, Ost	7 weeks	Face to face

Dispositional, no intervention

Paper	Journal	Authors	Year	Sample	N	Pre Means	Post Means	Difference	Pre SD	Post SD	value	d value	Intervention	Length of Interv.	Delivery
A Global Measure of Perceived Stress [16]	J of Health and Social Beh	Cohen, Kamarck & Mermelstein	1983	Students, majority fem, m age 19	332	23.18	N/A		7.31						
A Global Measure of Perceived Stress [16]	J of Health and Social Beh	Cohen, Kamarck & Mermelstein	1983	Students, approx. 50% gender split, m age 20.75	114	23.67	N/A		7.79						
A Global Measure of Perceived Stress [16]	J of Health and Social Beh	Cohen, Kamarck & Mermelstein	1983	Smoking Cessation, cohabiting or married, m age 38.4	64	25	N/A		8						

Appendix A: Table to show literature examining the change in PSS using different interventions-available in the online version of this paper

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