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Reducing compulsive Internet use and anxiety symptoms via two brief interventions: A comparison between mindfulness and gradual muscle relaxation

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Background: Compulsive Internet use (CIU) refers to those individuals who experience a loss of control regarding their online use. Although suffered by a minority, a much larger proportion of adults report to be experiencing early signs of CIU, which can become more problematic if sustained over time, especially when used as a coping mechanism for stress. Since compulsive behaviors are characterized by executing behaviors on "automatic pilot," mindfulness techniques, which help individuals relate more consciously with their environment, could help develop a more adaptive relationship with technology. However, mindfulness interventions are often lengthy hence not ideal for busy individuals with early signs of CIU. *Aims:* This study tested the effectiveness of a brief mindfulness intervention (10 min a day for 2 weeks) to reduce CIU and anxiety and depression symptoms, in relation to an equivalent length classic arousal descending technique (i.e., gradual-muscle-relaxation), and a wait-list control group. *Methods:* A randomized controlled trial (RCT) was used with assessments at pre- and post-phases. Participants showing initial signs of CIU were allocated to a mindfulness-group ($n = 343$), gradual-relaxation ($n = 301$), or a wait-list control group ($n = 350$). *Results:* The mindfulness and gradual-muscle-relaxation participants were equally effective in reducing anxiety and depression. The mindfulness intervention was more effective reducing CIU symptoms. *Discussion:* Given the large sample sizes of this RCT, these results are promising, although follow-up studies are needed. Considering health hazards of the "always-on-culture" and the popularity of bite-sized learning, the effectiveness of easy-to fit-in daily life health practices is a positive development.

Keywords: randomized controlled trial, mindfulness, gradual muscle relaxation, compulsive Internet use, anxiety and depression, always-on-culture

INTRODUCTION

The ability to respond to work demands that smartphones provide is sometimes mistaken with an obligation to do so, particularly when organizations reward "24/7 connectivity." This is particularly the case for those who experience compulsive Internet use (CIU), that is, those who struggle to integrate the Internet adaptively in their lives, to the point of experiencing conflict and loss of control over its use (Griffiths, Shonin, & Van Gordon, 2016). Although these symptoms are suffered by only a minority population (Kuss, Griffiths, Karila, & Billieux, 2014), a much larger proportion of adults report high engagement with the Internet and some of the early signs of CIU (such as excessive use; Charlton & Danforth, 2009; Meerkerk, van den Eijnden, Franken, & Garretsen, 2010). Importantly, high engagement increases the likelihood of developing more harmful CIU symptoms, particularly if stressful life events arise (Davis, 2001; Quinones & Kakabadse, 2015). Considering the negative impact of this maladaptive coping mechanism, practitioners should aim to prevent stress via effective psychological recovery strategies.

Psychological recovery after work is a fundamental health process, which allows individuals to replenish resources and prevent the often useful and unavoidable daily stressors from accumulating into chronic and harmful stresses (Geurts & Sonnentag, 2006; Quinones & Griffiths, 2017; Quinones, Rodriguez-Carvajal, & Griffiths, 2017). While many individuals have strategies and resources to organize their leisure and work time effectively, those working long hours might be more vulnerable to suffer the consequences of intermittent, unstructured, and/or limited recovery time (Quinones & Griffiths, 2017). Considering the accessibility to the endless source of stimuli on the Internet, and individuals' ability to switch intermittently between work and leisure, it is not unreasonable to expect long-hour workers to use Internet-enabled activities to help them switch off. In fact, some studies have demonstrated a mutually reinforcing relationship between CIU and compulsive work (e.g., Quinones, Griffiths, & Kakabadse, 2016).

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Furthermore, a recent diary study found that those using the Internet excessively after the working day to switch off from work reported lower recovery experience and higher levels of stress than those who engaged in a wider range of recovery activities (Quinones & Griffiths, 2017).

A highly effective way of achieving psychological recovery is the reduction of high emotional arousal generated by individuals' experiences of being overwhelmed in dealing with the demands placed upon them. Perhaps, the two most popular techniques in attempting to overcome such stressors are gradual muscle relaxation (Mackereth & Tomlinson, 2010) and mindfulness meditation (Van Gordon, Shonin, Dunn, Garcia-Campayo, & Griffiths, 2017; Van Gordon, Shonin, Dunn, Garcia-Campayo, Marcelo, et al., 2017; Van Gordon, Shonin, Zangeneh, & Griffiths, 2014). While the former relies on gentle contraction and releasing muscle exercises to reduce arousal (i.e., relies on the body), the latter trains an individual's attention, to focus on the present moment (i.e., relies on the mind; Shonin, Van Gordon, Compare, Zangeneh, & Griffiths, 2015). Considering the state of "automatic pilot" associated with CIU, mindfulness, as a technique that relies on training the attention, appears to be a more pertinent intervention to help reduce the signs of CIU.

Mindfulness has been defined as "*paying attention in a particular way: on purpose, in the present moment, and non-judgmentally*" (Kabat-Zinn, 1994, p. 4), and interventions involving mindfulness are proving effective in their application to treat a wide range of mental health problems, including depression, anxiety, and various behavioral addictions (Griffiths et al., 2016; Shonin, Van Gordon, & Griffiths, 2015; Van Gordon, Shonin, Dunn, Garcia-Campayo, Marcelo, et al., 2017). Mindfulness interventions typically include awareness of the body, mindful movement, and sitting meditation (Kabat-Zinn, 2003). The focus in the present moment, and accepting unwanted thoughts and emotions, can be particularly suited to helping those experiencing difficulties or problems as a result of their excessive engagement with the Internet, since often they are preoccupied with finding the next opportunity to engage on it. Nonetheless, there is an important obstacle when it comes to implementing these interventions among long-hour workers with early signs of CIU and that is the time commitment. These people are by definition struggling to find spare time, or may not be prepared to invest much time in a treatment when the problem has not fully developed. Such interventions are typically 8 weeks long and participants must engage in a minimum of 25–50 min practice a day (Van Gordon, Shonin, & Griffiths, 2016, Van Gordon, Shonin, Dunn, Garcia-Campayo, Marcelo, et al., 2017). Importantly, there is some preliminary evidence that supports the use of shorter, self-guided mindfulness interventions (Cavanagh et al., 2013; Krusche, Cyhlarova, & Williams, 2013). The problem with these studies is that it is scarce and the research designs have not always been as rigorous as they could be (e.g., involving alternative treatment groups, follow-ups, etc.). However, more recently, a meta-analysis based on eight randomized control trials found support for shorter, self-guided mindfulness interventions being effective in improving psychological well-being (Jayawardene, Lohrmann, Erbe, & Torabi, 2017).

Based on the extant literature, the aim of this study was to test the effectiveness of short and flexible self-led intervention (10 min a day for 2 weeks), that is easier to integrate into people's busy lives, among individuals who exhibited early signs of CIU and who work long hours. Methodologically, the aim was to address some of the existing limitations of many randomized controlled trials (RCTs), which either rely on very small sample sizes and/or lack an alternative intervention or control group (e.g., Davidson & Kaszniak, 2015; Fischer, Stanszus, Geiger, Grossman, & Schrader, 2017; Van Gordon, Shonin, Dunn, Garcia-Campayo, Marcelo, et al., 2017). The hypotheses were:

– *Hypothesis 1 (H1):* Participants randomized to the mindfulness condition would report greater improvements in mindfulness at post-program compared to both those randomized to the wait-list control condition and the relaxation group.
– *Hypothesis 2 (H2):* Participants randomized to the mindfulness condition would report greater reduction in CIU at post-program than those randomized to the wait-list control condition.
– *Hypothesis 3 (H3):* Participants randomized to gradual muscle relaxation would report greater reduction in CIU at post-program than those randomized to the wait-list control condition.

Although both relaxation and mindfulness interventions have extensively demonstrated their ability to reduce a number of symptoms associated with various disorders (e.g., Abbott et al., 2014; Brown & Ryan, 2003; Mackereth & Tomlinson, 2010; Zargarzadeh & Shirazi, 2014), there is also evidence suggesting that they do so through very different mechanisms. For instance, in a recent study, Sevinc et al. (2018) tested the different brain activities of interventions that gave participants two different instructions – to be relaxed versus to be mindful. Although both interventions were successful in reducing stress responses, self-report and neural activity measures showed that the relaxation instruction group showed changes in physical/autonomic relaxation, whereas the mindfulness group showed changes in areas of sensory awareness and salience. These findings support the two different processes consistent with the theoretical foundation of each program intervention. The impact of mindfulness interventions on these areas of the brain has also been found in several studies (Fox et al., 2014; Wheeler, Arnkoff, & Glass, 2017). In line with these findings, it was expected that focusing on the present moment intervention would be more effective in coming out of the automatic pilot that is often associated with compulsive use than an intervention to gradually contract and relax the muscles.

– *Hypothesis 4 (H4):* Participants randomized to mindfulness meditation would report greater reduction in CIU at post-program than those randomized in the gradual relaxation condition.

Mindfulness meditation has been found to lower anxiety in various studies (e.g., Bajaj, Robins, & Pande, 2016; Ostafin, Brooks, & Laitem, 2014; Zeidan, Martucci, Kraft, McHaffie, & Coghill, 2013). One of the mechanisms explaining this effect appears to be the impact that mindfulness has on self-referential thought processes

(Zeidan et al., 2013). Similarly, gradual muscle relaxation has also been found to reduce anxiety levels in a wide variety of scenarios (Hashim, Ahmad, & Yusof, 2011; Mackereth & Tomlinson, 2010; Zargarzadeh & Shirazi, 2014). In this case, the mechanism is more likely to be the direct reduction of arousal over time. Regardless of the different mechanisms explaining the efficacy of these interventions, it was anticipated that both interventions would be similarly effective in reducing anxiety levels in both groups.

– *Hypothesis 5 (H5):* There would be no difference in anxiety scores in both the muscle relaxation group and the mindfulness group.

METHODS

Procedure and participants

A randomized controlled trial with pre- and post-intervention measures (i.e., immediately after), with three groups (i.e., mindfulness, gradual relaxation, and control group) was carried out. Participants were recruited via a market research agency. In order to fulfill the aims of this study, participants who met all the following criteria were selected for study inclusion:

– Worked long hours (i.e., more than 40 hr per week).
– Showed initial signs of CIU (i.e., scores >28 as recommended by Meerkerk et al., 2010).
– Lived with partners (given that the key dimension of CIU is family conflicts caused by excessive Internet use).
– Lacked mindfulness experience (to limit the confounding effect of mindfulness experience).

A total of 993 participants fulfilled the criteria and were invited to participate in the study. For a period of two consecutive weeks, participants were randomly assigned to one of the three groups: mindfulness group ($n = 343$), gradual relaxation group ($n = 301$), or a wait-list control group ($n = 350$). Those in the mindfulness group were given a code to access a well-known mindfulness application (i.e., *Headspace*) where mindfulness is explained step-by-step to the users. The users were given daily access for 10-min meditation podcasts via the app or directly from the website. The application sent daily reminders to all participants.

The muscular relaxation group was given access to a 10-min muscular relaxation podcast. The control group received no specific intervention. After the study, all participants were allowed to access the different intervention resources, so that they all could enjoy the benefits of different practice. At the end of the 2-week programs, participants were asked to complete a post-intervention questionnaire. Some participants were lost due to either not completing the 2-week practice as well as a minority of individuals who carried out the training but failed to complete the post-test questionnaire (Figure 1).

Table 1 summarizes the relevant demographic data concerning the study participants at pre- and post-interventions. χ^2 test and analysis of variance (ANOVA) were conducted to rule out any potential pre-test differences between groups on the relevant variables of study. Since no significant differences between groups were found, randomization was deemed a success. Furthermore, considering the dropout at post-intervention, χ^2 tests and ANOVA were also carried out to rule out any significant difference between the pre- and post-intervention groups in the relevant variables of study. No significant differences were found.

Data analysis

Pre- and post-intervention scores for mindfulness, CIU, anxiety, and depression scales were analyzed using analysis of covariance (ANCOVA), with baseline scores entered as covariate in order to account for potential baseline differences between groups. Finally, post-hoc Tukey's tests were run for all comparisons of post-intervention group means to prevent Type I errors.

Materials

Compulsive Internet use (CIU). To assess CIU, Meerkerk et al.'s (2010) 14-item scale was used and two additional

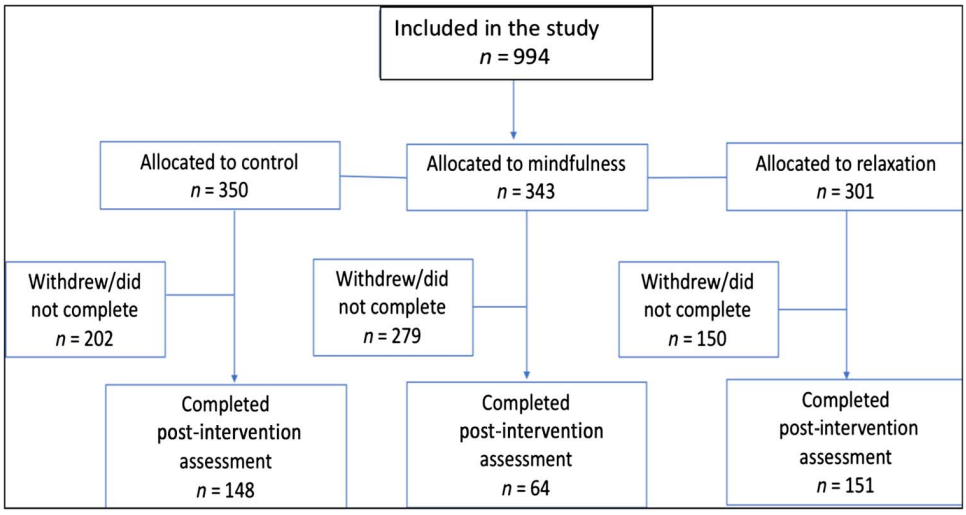

Figure 1. Flow diagram of participants through study stages

Table 1. Baseline characteristics of participants

	Mindfulness (pre/post)	Muscle relaxation (pre/post)	Control (pre/post)
Sample size	343/64	301/151	350/148
Age (years)	39/41	40/41	41/42
Female	132/22	125/59	131/63
Graduated from university (%)	68/73	65/62	71/63
Married (%)	73/79	76/80	74/74

items from Quinones et al. (2017) were added. The scale included items such as: "How often do you feel depressed or irritated when you cannot use the Internet?" Items are rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were mean averaged for each scale. Cronbach's αs for this study were .90 at Time 1 and .95 at Time 2.

Mindfulness. The Five Facet Mindfulness Questionnaire assesses five elements of mindfulness (observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience; Baer et al., 2008). Items are rated on a 5-point scale ranging from 1 (*always*) to 5 (*never*). This study focused on the observing subscale, with items concerning noticing thoughts, emotions, feelings sensations, and external experiences. A sample item is: "I pay attention to physical experiences, such as the wind in my hair or sun." Cronbach's αs for this study were .77 at Time 1 and .86 at Time 2.

Anxiety and depression. The Patient-Health Questionnaire-4 is a 4-item scale that assesses depression and anxiety rated on a 4-point Likert-type scale from 0 (*not at all*) to 3 (*nearly every day*) (Löwe et al., 2010). A sample item is "Over the last two weeks, how often have you been bothered by feeling nervous, anxious, or on edge." Cronbach's αs for this study were .88 at Time 1 and .91 at Time 2.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the Open University Business School approved the study. Participants were informed about the study, provided informed consent, and were told that they could stop participating at any time in the study. In order to incentivize participation, the market research company offered participants points, which were transferrable to loyalty rewards applicable to different companies they joined in the panel. Previous studies have confirmed how small vouchers do not significantly affect participants' actual response (Pieper, Kotte, & Ober, 2018).

RESULTS

A one-way ANCOVA was conducted to test the effectiveness of the three interventions on each of the outcome variables while controlling for the baseline levels of each outcome variable at a time (Table 2). There were significant differences on all three outcome variables: mindfulness [$F(2, 359) = 154.54$, $p < .001$], CIU [$F(2, 359) = 207.98$, $p = .001$], and on anxiety and depression [$F(2, 359) = 137.82$, $p < .001$].

Post-hoc Tukey's tests showed that the mindfulness post-intervention group mean was significantly lower than both the control and the relaxation post-intervention group observation mindfulness means (note that the scores are reversed). As expected, no differences between the control and gradual relaxation groups were found. Thus, *H1* was supported. Post-hoc tests also showed that the relaxation post-intervention group mean on CIU was significantly lower than the control group, but the meditation post-intervention group mean was significantly lower than both the control and relaxation group means. Comparing the estimated marginal means (i.e., adjusted means controlling for the baseline variable for each group, thereby statistically removing the effect of baseline levels of that variable), the strongest reduction on CIU was in the mindfulness group (mean = 2.79) compared to gradual relaxation and control (mean = 3.02,3.23) respectively. In short, *H2–H4* were supported.

Table 2. Adjusted post-intervention group means, confidence intervals, and effect sizes based on ANCOVA

	Control post-intervention	Mindfulness post-intervention	Relaxation post-intervention	*F* test for ANCOVA analysis	*d*
Internet addiction	3.23 (0.06)	2.79 (0.09)**	3.02 (0.06)**	$F(2, 359) = 207.98$; $p < .001$	0.37
	95% CI [3.11, 3.34]	95% CI [2.61, 2.97]	95% CI [2.90, 3.13]		
Obs_mindfulness	2.69 (0.06)	2.46 (0.08)**	2.83 (0.06)	$F(2, 359) = 154.54$; $p < .001$	0.30
	95% CI [2.57, 2.81]	95% CI [2.28, 2.63]	95% CI [2.71, 2.94]		
Anxiety and depression	2.09 (0.06)	1.77 (0.09)*	1.92 (0.06)*	$F(2, 359) = 137.82$; $p < .001$	0.28
	95% CI [1.97, 2.20]	95% CI [1.59, 1.94]	95% CI [1.81, 2.03]		

Note. Standard errors are in parentheses. ANCOVA: analysis of covariance; *F*: degrees of freedom between groups [(N_{Groups}−1), total ($N_{Individuals}$−1)]; CI: confidence interval.
*Significant difference from control group post-intervention mean, $p < .05$. **Significant difference from control and relaxation group post-intervention means, $p < .05$. *F*(*df* between, *df* within) *d* (Cohen's *d*) for study condition.

Finally, post-hoc Tukey's tests showed that both the relaxation and the mindfulness post-intervention anxiety and depression group means were significantly lower than the control group means. Although the estimated marginal means showed the lowest anxiety and depression scores, there were no significant differences between the mindfulness and the relaxation post-intervention group means (means = 1.77 and 1.92). Therefore, *H5* was supported.

DISCUSSION

The results of this randomized controlled trial demonstrated that there was a significant improvement in mindfulness scores, a reduction on early signs of CIU and a reduction on anxiety and depression symptoms for those participants on the 10-day/10-min-a-day mindfulness intervention. With regard to the comparison with the gradual relaxation intervention, this study found that the latter was also effective in significantly reducing CIU, and anxiety and depression symptoms, although the strength of the effect was significantly weaker than the mindfulness program for reducing CIU.

In recent years, many mindfulness interventions have proved to be successful in improving a wide number of wellbeing indicators as assessed using RCT designs, (e.g., Canby, Cameron, Calhoun, & Buchanan, 2015; Creswell, 2017; Jain et al., 2007; Van Gordon, Shonin, Dunn, Garcia-Campayo, & Griffiths, 2017; Zeidan et al., 2013) internet-based interventions, and brief interventions (Andreu, Cosmelli, Slagter, & Franken, 2018; Canby et al., 2015). The present study has three notable contributions to the extant literature. First, unlike many other studies, the present study used both an active control group and alternative intervention as recommended by relevant experts in the field (Van Gordon, Shonin, Dunn, Garcia-Campayo, Marcelo, et al., 2017). Second, for an RCT, the present study's sample sizes are very large. RCTs rely on a number of resources, in addition to obtaining and maintaining participant's motivation which often result in low sample sizes. Although there was significant participant withdrawal the study still managed to secure well over 50 participants per condition at post-intervention. Third, participants were carefully selected to match the characteristics of the population that was under study. This appears an obvious step for any study, but it is often not possible given the difficulty of participant recruitment and motivation needed to get a large enough sample for statistical power. Thus, many RCTs use more accessible samples (often university students) to achieve enough statistical power, which often do not accurately reflect the characteristics of the target population (e.g., Jain et al., 2007; Shearer, Hunt, Chowdhury, & Nicol, 2016). In short, given the large sample sizes of the present RCT, and the specific screening of participants, the positive effects of this brief mindfulness intervention are promising.

More specifically, the study's findings contribute to body of work examining the impact of mindfulness interventions on problematic behaviors and addictions. Mindfulness is a particularly pertinent treatment for addictions because – as Creswell (2017) argues – it allows practitioners to "observe the rise and fall of cravings and the behaviors they encourage and offer the opportunity of more skilful action." Thus, mindfulness has been found to reduce nicotine smoking cravings more than cognitive-behavioral therapy (Garland, Roberts-Lewis, Tronnier, Graves, & Kelley, 2016). In relation to alcohol, Garland et al. (2016) found that mindfulness intervention reduced alcohol attentional bias and reduced thought suppression and stress associated with alcohol dependence. These results are also found for brief interventions because Andreu et al. (2018) found that brief mindfulness practice enhanced response inhibition among cigarette smokers.

In relation to the different impact of relaxation versus mindfulness interventions on compulsive behavior, the stronger reduction of mindfulness on CIU found in this study is consistent with the different brain paths that mindfulness and relaxation interventions elicited in the study by Sevinc et al. (2018) where only the mindfulness intervention resulted in changes in salience and sensory awareness areas. The findings are also consistent with studies showing the impact of mindfulness interventions on cognitive control brain areas in several studies (e.g., Jha, Krompinger, & Baime, 2007; Tang, Lu, Fan, Yang, & Posner, 2012).

Considering the relevance of the intervention for the participants of study (i.e., long-hour workers with early signs of CIU), the findings of this study have implications for the implementation of work-related health promotion activities. Therefore, these brief interventions are particularly suited for those who find little time to engage on effective psychological recovering activities. The latter is fundamental in our "always-on-cultures," in order to prevent burnout and encourage a productive workforce and considering the easy access and limited financial investment it requires. Nonetheless, caution is warranted until additional replication studies have been conducted.

In addition to further follow-up studies, this study has some limitations that need acknowledging in interpreting the findings: (a) the brief intervention effects may be transient; (b) the sample sizes were reduced due to attrition prior to post-intervention phase; (c) all of the measures were self-report; thus, the study carries the same methodological limitations that any other study using self-report does (e.g., social desirability bias and subjectivity); (d) because the data were collected by a market research company, it is not known how many individuals completed the initial recruitment forms because the market research company was instructed to recruit participants under the selection criteria provided. Consequently, the number of excluded participants is unknown. However, the criteria were not too restrictive and it did not take long to recruit the final sample (less than a week); (e) considering the limited number of variables that were focused upon, it is always possible that other variables may explain true differences between groups; (f) there was an uneven dropout between treatment arms, with the dropout being higher in the mindfulness intervention group. However, this should not compromise the findings as Bell, Kenward, Fairclough, and Horton (2013) found that "*through careful examination and documentation of the missingness mechanism(s) … bias can be eliminated or reduced*" (pp. 3–4). Because there were no significant differences between the pre- and post-intervention groups in the relevant variables of study, there was no evidence supporting

the existence of bias. Nevertheless, in this study, we cannot rule out the possibility that the mindfulness intervention requires a higher level of effort for individuals than the gradual muscle relaxation intervention, so further research to clarify this is required. Finally, there is also a more fundamental arguably philosophical matter about of how and whether mindfulness can even be measured (Davidson & Kaszniak, 2015). In short, considering existing concerns with the potential health hazards of the "always-on-cultures" and the interest for targeted "bite-sized" learning in different fields, confirming the effectiveness of short, easy-to-fit-in health practices in daily life is a positive development in enjoying the benefits of a technology-enhanced society.

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REFERENCES

Abbott, R. A., Whear, R., Rodgers, L. R., Bethel, A., Coon, J. T., Kuyken, W., Stein, K., & Dickens, C. (2014). Effectiveness of mindfulness-based stress reduction and mindfulness based cognitive therapy in vascular diseases: A systematic review and meta-analysis of randomized controlled trials. *Journal of Psychosomatic Research, 76*(5), 341–351. doi:10.1016/j.jpsychores.2014.02.012

Andreu, C. I., Cosmelli, D., Slagter, H. A., & Franken, I. H. A. (2018). Effects of a brief mindfulness-meditation intervention on neural measures of response inhibition in cigarette smokers. *PLoS One, 13*(1), e0191661. doi:10.1371/journal.pone.0191661

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., & Williams, J. M. G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and non-meditating samples. *Assessment, 15*(3), 329–342. doi:10.1177/1073191107313003

Bajaj, B., Robins, R. W., & Pande, N. (2016). Mediating role of self-esteem on the relationship between mindfulness, anxiety, and depression. *Personality and Individual Differences, 96,* 127–131. doi:10.1016/j.paid.2016.02.085

Bell, M. L., Kenward, M. G., Fairclough, D. L., & Horton, N. J. (2013). Differential dropout and bias in randomised controlled trials: When it matters and when it may not. *BMJ, 346,* e8668. doi:10.1136/bmj.e8668

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822–848. doi:10.1037/0022-3514.84.4.822

Canby, N. K., Cameron, I. M., Calhoun, A. T., & Buchanan, G. M. (2015). A brief mindfulness intervention for healthy college students and its effects on psychological distress, self-control, meta-mood, and subjective vitality. *Mindfulness, 6,* 1071–1081. doi:10.1007/s12671-014-0356-5

Cavanagh, K., Strauss, C., Cicconi, F., Griffiths, N., Wyper, A., & Jones, F. (2013). A randomised controlled trial of a brief online mindfulness-based intervention. *Behaviour Research and Therapy, 51*(9), 573–578. doi:10.1016/j.brat.2013.06.003

Charlton, J. P., & Danforth, I. D. W. (2009). Distinguishing addiction and high engagement in the context of online game playing. *Computers in Human Behavior, 23*(3), 1531–1548. doi:10.1016/j.chb.2005.07.002

Creswell, D. J. (2017). Mindfulness interventions. *Annual Review of Psychology, 68*(1), 491–516. doi:10.1146/annurev-psych-042716-051139

Davidson, R. J., & Kaszniak, A. W. (2015). Conceptual and methodological issues in research on mindfulness and meditation. *American Psychologist, 70*(7), 581–592. doi:10.1037/a0039512

Davis, R. A. (2001). A cognitive-behavioral model of pathological Internet use. *Computers in Human Behavior, 17*(2), 187–195. doi:10.1016/S0747-5632(00)00041-8

Fischer, D., Stanszus, L., Geiger, S., Grossman, P., & Schrader, U. (2017). Mindfulness and sustainable consumption: A systematic literature review of research approaches and findings. *Journal of Cleaner Production, 162*(C), 544–558. doi:10.1016/j.jclepro.2017.06.007

Fox, K. C., Nijeboer, S., Dixon, M. L., Floman, J. L., Ellamil, M., Rumak, S. P., Sedlmeier, P., & Christoff, K. (2014). Is meditation associated with altered brain structure? A systematic review and meta-analysis of morphometric neuroimaging in meditation practitioners. *Neuroscience and Biobehavioral Reviews, 43,* 48–73. doi:10.1016/j.neubiorev.2014.03.016

Garland, E. L., Roberts-Lewis, A., Tronnier, C. D., Graves, R., & Kelley, K. (2016). Mindfulness-oriented recovery enhancement versus CBT for co-occurring substance dependence, traumatic stress, and psychiatric disorders: Proximal outcomes from a pragmatic randomized trial. *Behaviour Research and Therapy, 77,* 7–16. doi:10.1016/j.brat.2015.11.012

Griffiths, M. D., Shonin, E. S., & Van Gordon, W. (2016). Mindfulness as a treatment for gambling disorder. *Journal of Gambling and Commercial Gaming Research, 1,* 47–52. doi:10.17536/jgcgr.2016.004

Geurts, S. A., & Sonnentag, S. (2006). Recovery as an explanatory mechanism in the relation between acute stress reactions and chronic health impairment. *Scandinavian Journal of Work, Environment & Health, 32*(6), 482–492. doi:10.5271/sjweh.1053

Hashim, H. A., Ahmad, H., & Yusof, H. (2011). The effects of progressive muscle relaxation and autogenic relaxation on young soccer players' mood states. *Asian Journal of Sports Medicine, 2*(2), 99–105. doi:10.5812/asjsm.34786

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., & Schwartz, G. E. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine, 33*(1), 11–21. doi:10.1207/s15324796abm3301_2

Jayawardene, W. P., Lohrmann, D. K., Erbe, R. G., & Torabi, M. R. (2017). Effects of preventive online mindfulness interventions on stress and mindfulness: A meta-analysis of randomized controlled trials. *Preventive Medicine Reports, 5,* 150–159. doi:10.1016/j.pmedr.2016.11.013

Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience, 7*(2), 109–119. doi:10.3758/CABN.7.2.109

Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness meditation in everyday life*. New York, NY: Hyperion.

Kabat-Zinn, J. (2003). Mindfulness-based intervention in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144–156. doi:10.1093/clipsy.bpg016

Krusche, A., Cyhlarova, E., & Williams, J. M. G. (2013). Mindfulness online: An evaluation of the feasibility of a web-based mindfulness course for stress, anxiety and depression. *BMJ Open, 3*(11), e003498. doi:10.1136/bmjopen-2013-003498

Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design, 20*(25), 4026–4052. doi:10.2174/13816128113199990617

Löwe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., Schneider, A., & Brähler, E. (2010). A 4-item measure of depression and anxiety: Validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *Journal of Affective Disorders, 122*(1–2), 86–95. doi:10.1016/j.jad.2009.06.019

Mackereth, P. A., & Tomlinson, L. (2010). Progressive muscle relaxation: A remarkable tool for therapists and patients. In A. Cawthorn, & P. Mackereth (Eds.), *Integrative hypnotherapy: Complementary approaches in clinical care* (pp. 82–96). London, UK: Elsevier Science.

Meerkerk, G., van den Eijnden, R. J. J. M., Franken, I. H. A., & Garretsen, H. F. L. (2010). Is compulsive Internet use related to sensitivity to reward and punishment, and impulsivity? *Computers in Human Behavior, 26*(4), 729–735. doi:10.1016/j.chb.2010.01.009

Ostafin, B. D., Brooks, J. J., & Laitem, M. (2014). Affective reactivity mediates an inverse relation between mindfulness and anxiety. *Mindfulness, 5*(5), 520–528. doi:10.1007/s12671-013-0206-x

Pieper, D., Kotte, N., & Ober, P. (2018). The effect of a voucher incentive on a survey response rate in the clinical setting: A quasi-randomized controlled trial. *BMC Medical Research Methodology, 18*(1), 86. doi:10.1186/s12874-018-0544-4

Quinones, C., & Griffiths, M. D. (2017). The impact of daily emotional demands, job resources and emotional effort on intensive internet use during and after work. *Computers in Human Behavior, 76,* 561–575. doi:10.1016/j.chb.2017.07.020

Quinones, C., Griffiths, M., & Kakabadse, N. (2016). Compulsive Internet use and workaholism: An exploratory two-wave longitudinal study. *Computers in Human Behavior, 60,* 492–499. doi:10.1016/j.chb.2016.02.060

Quinones, C., & Kakabadse, N. (2015). Self-concept clarity, social support, and compulsive Internet use: A study of the USA and the UAE. *Computers in Human Behavior, 44,* 347–356. doi:10.1016/j.chb.2014.11.019

Quinones, C., Rodriguez-Carvajal, R., & Griffiths, M. D. (2017). Testing a Eustress-distress emotion regulation model in British and Spanish front-line employees. *International Journal of Stress Management, 24,* 1–28. doi:10.1037/str0000021

Sevinc, G., Hölzel, B. K., Hashmi, J., Greenberg, J., McCallister, A., Treadway, M., Schneider, M. L., Dusek, J. A., Carmody, J., & Lazar, S. W. (2018). Common and dissociable neural activity after mindfulness-based stress reduction and relaxation response programs. *Psychosomatic Medicine, 80*(5), 439–451. doi:10.1097/PSY.0000000000000590

Shearer, A., Hunt, M., Chowdhury, M., & Nicol, L. (2016). Effects of a brief mindfulness meditation intervention on student stress and heart rate variability. *International Journal of Stress Management, 23*(2), 232–254. doi:10.1037/a0039814

Shonin, E., Van Gordon, W., Compare, A., Zangeneh, M., & Griffiths, M. D. (2015). Buddhist-derived loving-kindness and compassion meditation for the treatment of psychopathology: A systematic review. *Mindfulness, 6*(5), 1161–1180. doi:10.1007/s12671-014-0368-1

Shonin, E. S., Van Gordon, W., & Griffiths, M. D. (2015). Mindfulness in psychology: A breath of fresh air? *The Psychologist: Bulletin of the British Psychological Society, 28,* 28–31. Retrieved from https://thepsychologist.bps.org.uk/volume-28/january-2015/mindfulness-psychology-breath-fresh-air

Tang, Y. Y., Lu, Q., Fan, M., Yang, Y., & Posner, M. I. (2012). Mechanisms of white matter changes induced by meditation. *Proceedings of the National Academy of Sciences of the United States of America, 109*(26), 10570–10574. doi:10.1073/pnas.1207817109

Van Gordon, W., Shonin, E., Dunn, T., Garcia-Campayo, J., & Griffiths, M. D. (2017). Meditation Awareness Training for the treatment of fibromyalgia syndrome: A randomised controlled trial. *British Journal of Health Psychology, 22*(1), 186–206. doi:10.1111/bjhp.12224

Van Gordon, W., Shonin, E., Dunn, T.J., Garcia-Campayo, J., Marcelo, M. P. Demarzo, M. M. P., & Griffiths, M. D. (2017). Meditation Awareness Training for the treatment of workaholism: A non-randomised controlled trial. *Journal of Behavioral Addictions, 6*(2), 212–220. doi:10.1556/2006.6.2017.021

Van Gordon, W., Shonin, E., & Griffiths, M. D. (2016). Corporate use of mindfulness and authentic spiritual transmission: Competing or compatible ideals? *Mindfulness and Compassion, 1*(2), 75–83. doi:10.1016/j.mincom.2016.10.005

Van Gordon, W., Shonin, E., Zangeneh, M., & Griffiths, M. D. (2014). Can mindfulness really improve work-related mental health and job performance? *International Journal of Mental Health and Addiction, 12,* 129–137. doi:10.1007/s11469-014-9484-3

Wheeler, M. S., Arnkoff, D. B., & Glass, C. R. (2017). The neuroscience of mindfulness: how mindfulness alters the brain and facilitates emotion regulation. *Mindfulness, 8*(6), 1471–1487. doi:10.1007/s12671-017-0742-x

Zargarzadeh, M., & Shirazi, M. (2014). The effect of progressive muscle relaxation method on test anxiety in nursing students. *Iranian Journal of Nursing and Midwifery Research, 19*(6), 607–612.

Zeidan, F., Martucci, K. T., Kraft, R. A., McHaffie, J. G., & Coghill, R. C. (2013). Neural correlates of mindfulness meditation-related anxiety relief. *Social Cognitive and Affective Neuroscience, 9*(6), 751–759. doi:10.1093/scan/nst041