



MDITATESM

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Where meditation meets the art and science of life

While meditation has deep ancient and religious origins, it has recently become popular as a way to de-stress or cope with the whirlwind of modern living - but it is so much more than that. With consistent practice, meditation has profound effects on our physical health. It enhances our well-being and emotional outlook, which in part may account for these beneficial physical effects.

Compiled below is only the tip of the iceberg of peer-review, published science supporting meditation. Perhaps it will change the way that you look at 'just sitting and doing nothing.'

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Who is meditating and why?

Cramer H, Hall H, Leach M, et al. **Prevalence, patterns, and predictors of meditation use among US adults: a nationally representative survey.** Sci Rep. 2016;6:36760.

Abstract

Emerging evidence suggests substantial health benefits from using meditation. While there are some indications that the popularity of meditation is increasing, little is known about the prevalence, patterns, and predictors of meditation use in the general population. In this secondary analysis of data from the 2012 US National Health Interview Survey (NHIS) (n=34,525), lifetime and 12-month prevalence of meditation use were 5.2% and 4.1%, respectively. Compared to non-users, those who had used meditation in the past 12 months were more likely to be 40-64 years, female, non-Hispanic White, living in the West, at least college-educated, not in a relationship, diagnosed with one or more chronic conditions, smoking, consuming alcohol and physically active. Meditation was mainly used for general wellness (76.2%), improving energy (60.0%), and aiding memory or concentration (50.0%). Anxiety (29.2%), stress (21.6%), and depression (17.8%) were the top health problems for which people used meditation; 63.6% reported that meditation had helped a great deal with these conditions. Only 34.8% disclosed their use of meditation with a health provider. These findings indicate that about 9.3 million US adults have used meditation in the past 12 months; and that mental health problems were the most important reason for meditation use.

Lauricella S. **The ancient-turned-new concept of "spiritual hygiene": an investigation of media coverage of meditation from 1979 to 2014.** J Relig Health. 2016;55:1748-62.

Abstract

A spiritual-yet not religious-practice, meditation has been touted as beneficial to boosting the immune system, lowering blood pressure, alleviating migraines, and increasing gray matter in parts of the brain. While scientific research on meditation is beginning to quantify its benefits, there is increasing concern among the scientific community that news outlets glorify the potential benefits of meditation. This paper considers coverage of meditation in mainstream print media by analyzing 764 articles printed in English from worldwide media outlets from 1979 to 2014. Frame theory analysis is employed to better understand how meditation is presented in print media and how the perception of the practice is interpreted by readers. Results indicate that articles reflect the health and wellness challenges present in contemporary culture, together with a desire for personal relief from such issues. The paper suggests that the practice of meditation as "spiritual hygiene" is indicative of a sociocultural shift in which meditative techniques are becoming increasingly recognized, encouraged, and practiced.

Khoury B, Knäuper B, Schlosser M, et al. **Effectiveness of traditional meditation retreats: A systematic review and meta-analysis.** J Psychosom Res. 2017;92:16-25.

Abstract

An increasing number of studies are investigating traditional meditation retreats. Very little, however, is known about their effectiveness. To evaluate the effectiveness of meditation retreats on improving psychological outcomes in general population. A systematic review of

studies published in journals or as dissertations in PSYCINFO, PUBMED, CINAHL or Web of Science from the first available date until October 22, 2016. A total of 20 papers (21 studies, N=2912) were included. Effect-size estimates of outcomes combined suggested that traditional meditation retreats are moderately effective in pre-post analyses (n=19; Hedge's $g=0.45$; 95% CI [0.35, 0.54], $p<0.00001$) and in analyses comparing retreats to controls (n=14; Hedge's $g=0.49$; 95% CI [0.36, 0.61], $p<0.00001$). Results were maintained at follow-up. No differences were observed between meditation styles. Results suggested large effects on measures of anxiety, depression and stress, and moderate effects on measures of emotional regulation and quality of life. As to potential mechanisms of actions, results showed large effects on measures of mindfulness and compassion, and moderate effects on measures of acceptance. In addition, changes in mindfulness levels strongly moderated clinical effect sizes. However, heterogeneity was significant among trials, probably due to differences in study designs, types and duration of the retreats and assessed outcomes, limiting therefore the implications of the results. Meditation retreats are moderately to largely effective in reducing depression, anxiety, stress and in ameliorating the quality of life of participants.

Chiesa A, Serretti A. **Mindfulness-based stress reduction for stress management in healthy people: a review and meta-analysis.** J Altern Complement Med. 2009;15:593-600. Abstract

Mindfulness-based stress reduction (MBSR) is a clinically standardized meditation that has shown consistent efficacy for many mental and physical disorders. Less attention has been given to the possible benefits that it may have in healthy subjects. The aim of the present review and meta-analysis is to better investigate current evidence about the efficacy of MBSR in healthy subjects, with a particular focus on its benefits for stress reduction. A literature search was conducted using MEDLINE (PubMed), the ISI Web of Knowledge, the Cochrane database, and the references of retrieved articles. The search included articles written in English published prior to September 2008, and identified ten, mainly low-quality, studies. Cohen's d effect size between meditators and controls on stress reduction and spirituality enhancement values were calculated. MBSR showed a nonspecific effect on stress reduction in comparison to an inactive control, both in reducing stress and in enhancing spirituality values, and a possible specific effect compared to an intervention designed to be structurally equivalent to the meditation program. A direct comparison study between MBSR and standard relaxation training found that both treatments were equally able to reduce stress. Furthermore, MBSR was able to reduce ruminative thinking and trait anxiety, as well as to increase empathy and self-compassion. MBSR is able to reduce stress levels in healthy people. However, important limitations of the included studies as well as the paucity of evidence about possible specific effects of MBSR in comparison to other nonspecific treatments underline the necessity of further research.

Laneri D, Krach S, Paulus FM, et al. **Mindfulness meditation regulates anterior insula activity during empathy for social pain.** Hum Brain Mapp. 2017 May 15. [Epub ahead of print]

Abstract

Mindfulness has been shown to reduce stress, promote health, and well-being, as well as to increase compassionate behavior toward others. It reduces distress to one's own painful

experiences, going along with altered neural responses, by enhancing self-regulatory processes and decreasing emotional reactivity. In order to investigate if mindfulness similarly reduces distress and neural activations associated with empathy for others' socially painful experiences, which might in the following more strongly motivate prosocial behavior, the present study compared trait, and state effects of long-term mindfulness meditation (LTM) practice. To do so we acquired behavioral data and neural activity measures using functional magnetic resonance imaging (fMRI) during an empathy for social pain task while manipulating the meditation state between two groups of LTM practitioners that were matched with a control group. The results show increased activations of the anterior insula (AI) and anterior cingulate cortex (ACC) as well as the medial prefrontal cortex and temporal pole when sharing others' social suffering, both in LTM practitioners and controls. However, in LTM practitioners, who practiced mindfulness meditation just prior to observing others' social pain, left AI activation was lower and the strength of AI activation following the mindfulness meditation was negatively associated with trait compassion in LTM practitioners. The findings suggest that current mindfulness meditation could provide an adaptive mechanism in coping with distress due to the empathic sharing of others' suffering, thereby possibly enabling compassionate behavior.

Meditation and aging

Luders E, Cherbuin N. **Searching for the philosopher's stone: promising links between meditation and brain preservation.** Ann N Y Acad Sci. 2016;1373:38-44.

Abstract

In the context of an aging population and increased prevalence of dementia and other neurodegenerative diseases, developing strategies to decrease the negative effects of aging is imperative. The scientific study of meditation as a potential tool to downregulate processes implicated in brain aging is an emerging field, and a growing body of research suggests that mindfulness practices are beneficial for cerebral resilience. Adding further evidence to this notion, an increasing number of imaging studies report effects of meditation on brain structure that are consistent with our understanding of neuroprotection. Here, we review the published findings in this field of research addressing the question of whether meditation diminishes age-related brain degeneration. Altogether, although analyses are still sparse and based on cross-sectional data, study outcomes suggest that meditation might be beneficial for brain preservation-both with respect to gray and white matter-possibly by slowing down the natural (age-related) decrease of brain tissue. Nevertheless, it should also be recognized that, until robust longitudinal data become available, there is no evidence for causation between meditation and brain preservation. This review includes a comprehensive commentary on limitations of the existing research and concludes with implications and directions for future studies.

Kurth F, Cherbuin N, Luders E. **Promising links between meditation and reduced (brain) aging: an attempt to bridge some gaps between the alleged fountain of youth and the youth of the field.** Front Psychol. 2017;8:860.

Abstract

Over the last decade, an increasing number of studies has reported a positive impact of meditation on cerebral aging. However, the underlying mechanisms for these seemingly

brain-protecting effects are not well-understood. This may be due to the fact, at least partly, that systematic empirical meditation research has emerged only recently as a field of scientific scrutiny. Thus, on the one hand, critical questions remain largely unanswered; and on the other hand, outcomes of existing research require better integration to build a more comprehensive and holistic picture. In this article, we first review theories and mechanisms pertaining to normal (brain) aging, specifically focusing on telomeres, inflammation, stress regulation, and macroscopic brain anatomy. Then, we summarize existing research integrating the developing evidence suggesting that meditation exerts positive effects on (brain) aging, while carefully discussing possible mechanisms through which these effects may be mediated.

Sperduti M, Makowski D, Blondé P, et al. **Meditation and successful aging: can meditative practices counteract age-related cognitive decline?** *Geriatr Psychol Neuropsychiatr Vieil*. 2017;15:205-213.

Abstract

Life expectancy is constantly increasing in the developed countries due to medical, hygiene and socio-economic advances. Unfortunately, a longer life not always corresponds to a healthier life. Indeed, aging is associated with growing risk factors for illness associated with societal conditions (isolation, maltreatment), and neurodegenerative diseases. Even normal aging is associated with a cognitive decline that can hinder independence and quality of life of elderly. Thus, one major societal challenge is to build policies that support people of all ages to maintain a maximum health and functional capacity throughout their lives. Meditation could be a promising intervention in contrasting the negative effects of aging. Indeed, it has been shown to enhance cognitive efficiency in several domains, such as attention and executive functions in young adults. Nevertheless, whether these effects extend to old participants is still a matter of debate. Few studies have directly investigated this issue, reporting encouraging results in a large panel of cognitive functions, such as: attention, executive functions and memory. However, a final conclusion about the causal role of meditation and the generalization of these results is made difficult due to several methodological limitations. We propose a roadmap for future studies to pass these limitations with the hope that the present work would contribute to the development of the young research field of meditation in gerontology.

Laneri D, Schuster V, Dietsche B, et al. **Effects of long-term mindfulness meditation on brain's white matter microstructure and its aging.** *Front Aging Neurosci*. 2016;7:254.

Abstract

Although research on the effects of mindfulness meditation (MM) is increasing, still very little has been done to address its influence on the white matter (WM) of the brain. We hypothesized that the practice of MM might affect the WM microstructure adjacent to five brain regions of interest associated with mindfulness. Diffusion tensor imaging was employed on samples of meditators and non-meditators ($n = 64$) in order to investigate the effects of MM on group difference and aging. Tract-Based Spatial Statistics was used to estimate the fractional anisotropy of the WM connected to the thalamus, insula, amygdala, hippocampus, and anterior cingulate cortex. The subsequent generalized linear model analysis revealed group differences and a group-by-age interaction in all five selected regions. These data provide preliminary indications that the practice of MM might result in

WM connectivity change and might provide evidence on its ability to help diminish age-related WM degeneration in key regions which participate in processes of mindfulness.

Newberg AB, Serruya M, Wintering N, et al. **Meditation and neurodegenerative diseases.** Ann NY Acad Sci. 2014;1307:112-23.

Abstract

Neurodegenerative diseases pose a significant problem for the healthcare system, doctors, and patients. With an aging population, more and more individuals are developing neurodegenerative diseases and there are few treatment options at the present time. Meditation techniques present an interesting potential adjuvant treatment for patients with neurodegenerative diseases and have the advantage of being inexpensive, and easy to teach and perform. There is increasing research evidence to support the application of meditation techniques to help improve cognition and memory in patients with neurodegenerative diseases. This review discusses the current data on meditation, memory, and attention, and the potential applications of meditation techniques in patients with neurodegenerative diseases.

Gard T, Taquet M, Dixit R, et al. **Fluid intelligence and brain functional organization in aging yoga and meditation practitioners.** Frontiers in Aging Neuroscience [Internet]. 2014;6:76.

Abstract

Numerous studies have documented the normal age-related decline of neural structure, function, and cognitive performance. Preliminary evidence suggests that meditation may reduce decline in specific cognitive domains and in brain structure. Here we extended this research by investigating the relation between age and fluid intelligence and resting state brain functional network architecture using graph theory, in middle-aged yoga and meditation practitioners, and matched controls. Fluid intelligence declined slower in yoga practitioners and meditators combined than in controls. Resting state functional networks of yoga practitioners and meditators combined were more integrated and more resilient to damage than those of controls. Furthermore, mindfulness was positively correlated with fluid intelligence, resilience, and global network efficiency. These findings reveal the possibility to increase resilience and to slow the decline of fluid intelligence and brain functional architecture and suggest that mindfulness plays a mechanistic role in this preservation.

Gard T, Hölzel BK, Lazar SW. **The potential effects of meditation on age-related cognitive decline: a systematic review.** Annals of the New York Academy of Science [Internet]. 2014;1307:89-103.

Abstract

With a rapidly aging society it becomes increasingly important to counter normal age-related decline in cognitive functioning. Growing evidence suggests that cognitive training programs may have the potential to counteract this decline. On the basis of a growing body of research that shows that meditation has positive effects on cognition in younger and middle-aged adults, meditation may be able to offset normal age-related cognitive decline or even enhance cognitive function in older adults. In this paper, we review studies investigating the effects of meditation on age-related cognitive decline. We searched the Web of Science (1900 to present), PsycINFO (1597 to present), MEDLINE (1950 to present), and CABI (1910

to present) to identify original studies investigating the effects of meditation on cognition and cognitive decline in the context of aging. Twelve studies were included in the review, six of which were randomized controlled trials. Studies involved a wide variety of meditation techniques and reported preliminary positive effects on attention, memory, executive function, processing speed, and general cognition. However, most studies had a high risk of bias and small sample sizes. Reported dropout rates were low and compliance rates high. We conclude that meditation interventions for older adults are feasible, and preliminary evidence suggests that meditation can offset age-related cognitive decline.

Zeidan F, Johnson SK, Diamond BJ, et al.. **Mindfulness meditation improves cognition: evidence of brief mental training.** Conscious Cogn. 2010;19:597-605

Abstract

Although research has found that long-term mindfulness meditation practice promotes executive functioning and the ability to sustain attention, the effects of brief mindfulness meditation training have not been fully explored. We examined whether brief meditation training affects cognition and mood when compared to an active control group. After four sessions of either meditation training or listening to a recorded book, participants with no prior meditation experience were assessed with measures of mood, verbal fluency, visual coding, and working memory. Both interventions were effective at improving mood but only brief meditation training reduced fatigue, anxiety, and increased mindfulness. Moreover, brief mindfulness training significantly improved visuo-spatial processing, working memory, and executive functioning. Our findings suggest that 4 days of meditation training can enhance the ability to sustain attention; benefits that have previously been reported with long-term meditators.

Meditation and the brain structure

Boccia M, Piccardi L, Guariglia P. **The meditative mind: a comprehensive meta-analysis of MRI studies.** Biomed Res Int. 2015;2015:419808.

Abstract

Over the past decade mind and body practices, such as yoga and meditation, have raised interest in different scientific fields; in particular, the physiological mechanisms underlying the beneficial effects observed in meditators have been investigated. Neuroimaging studies have studied the effects of meditation on brain structure and function and findings have helped clarify the biological underpinnings of the positive effects of meditation practice and the possible integration of this technique in standard therapy. The large amount of data collected thus far allows drawing some conclusions about the neural effects of meditation practice. In the present study we used activation likelihood estimation (ALE) analysis to make a coordinate-based meta-analysis of neuroimaging data on the effects of meditation on brain structure and function. Results indicate that meditation leads to activation in brain areas involved in processing self-relevant information, self-regulation, focused problem-solving, adaptive behavior, and interoception. Results also show that meditation practice induces functional and structural brain modifications in expert meditators, especially in areas involved in self-referential processes such as self-awareness and self-regulation. These results demonstrate that a biological substrate underlies the positive pervasive effect of meditation

practice and suggest that meditation techniques could be adopted in clinical populations and to prevent disease.

Tang YY, Lu Q, Fan M, Yang Y, et al. **Mechanisms of white matter changes induced by meditation.** Proc Natl Acad Sci USA. 2012;109:10570-4.

Abstract

Using diffusion tensor imaging, several recent studies have shown that training results in changes in white matter efficiency as measured by fractional anisotropy (FA). In our work, we found that a form of mindfulness meditation, integrative body-mind training (IBMT), improved FA in areas surrounding the anterior cingulate cortex after 4-wk training more than controls given relaxation training. Reductions in radial diffusivity (RD) have been interpreted as improved myelin but reductions in axial diffusivity (AD) involve other mechanisms, such as axonal density. We now report that after 4-wk training with IBMT, both RD and AD decrease accompanied by increased FA, indicating improved efficiency of white matter involves increased myelin as well as other axonal changes. However, 2-wk IBMT reduced AD, but not RD or FA, and improved moods. Our results demonstrate the time-course of white matter neuroplasticity in short-term meditation. This dynamic pattern of white matter change involving the anterior cingulate cortex, a part of the brain network related to self-regulation, could provide a means for intervention to improve or prevent mental disorders.

Hölzel BK, Carmody J, Evans KC, et al. **Stress reduction correlates with structural changes in the amygdala.** Soc Cogn Affect Neurosci. 2010;5:11-7.

Abstract

Stress has significant adverse effects on health and is a risk factor for many illnesses. Neurobiological studies have implicated the amygdala as a brain structure crucial in stress responses. Whereas hyperactive amygdala function is often observed during stress conditions, cross-sectional reports of differences in gray matter structure have been less consistent. We conducted a longitudinal MRI study to investigate the relationship between changes in perceived stress with changes in amygdala gray matter density following a stress-reduction intervention. Stressed but otherwise healthy individuals (N = 26) participated in an 8-week mindfulness-based stress reduction intervention. Perceived stress was rated on the perceived stress scale (PSS) and anatomical MR images were acquired pre- and post-intervention. PSS change was used as the predictive regressor for changes in gray matter density within the bilateral amygdalae. Following the intervention, participants reported significantly reduced perceived stress. Reductions in perceived stress correlated positively with decreases in right basolateral amygdala gray matter density. Whereas prior studies found gray matter modifications resulting from acquisition of abstract information, motor and language skills, this study demonstrates that neuroplastic changes are associated with improvements in a psychological state variable.

Lazar SW, Kerr CE, Wasserman RH, et al. **Meditation experience is associated with increased cortical thickness.** Neuroreport. 2005;16:1893-7.

Abstract

Previous research indicates that long-term meditation practice is associated with altered resting electroencephalogram patterns, suggestive of long lasting changes in brain activity. We hypothesized that meditation practice might also be associated with changes in the

brain's physical structure. Magnetic resonance imaging was used to assess cortical thickness in 20 participants with extensive Insight meditation experience, which involves focused attention to internal experiences. Brain regions associated with attention, interoception and sensory processing were thicker in meditation participants than matched controls, including the prefrontal cortex and right anterior insula. Between-group differences in prefrontal cortical thickness were most pronounced in older participants, suggesting that meditation might offset age-related cortical thinning. Finally, the thickness of two regions correlated with meditation experience. These data provide the first structural evidence for experience-dependent cortical plasticity associated with meditation practice.

Meditation and depression, anxiety, stress, mental illness and PTSD

Greenberg J, Shapiro BG, Mischoulon D, et al. **Mindfulness-based cognitive therapy for depressed individuals improves suppression of irrelevant mental-sets.** European Archives of Psychiatry and Clinical Neuroscience [Internet]. 2016:1-6.

Abstract

An impaired ability to suppress currently irrelevant mental-sets is a key cognitive deficit in depression. Mindfulness-based cognitive therapy (MBCT) was specifically designed to help depressed individuals avoid getting caught in such irrelevant mental-sets. In the current study, a group assigned to MBCT plus treatment-as-usual ($n = 22$) exhibited significantly lower depression scores and greater improvements in irrelevant mental-set suppression compared to a wait-list plus treatment-as-usual ($n = 18$) group. Improvements in mental-set-suppression were associated with improvements in depression scores. Results provide the first evidence that MBCT can improve suppression of irrelevant mental-sets and that such improvements are associated with depressive alleviation.

Jain FA, Walsh RN, Eisendrath SJ, et al. **Critical analysis of the efficacy of meditation therapies for acute and subacute phase treatment of depressive disorders: a systematic review.** Psychosomatics. 2015;56:140-52.

Abstract

Recently, the application of meditative practices to the treatment of depressive disorders has met with increasing clinical and scientific interest, owing to a lower side-effect burden, potential reduction of polypharmacy, and theoretical considerations that such interventions may target some of the cognitive roots of depression. We aimed to determine the state of the evidence supporting this application. Randomized controlled trials of techniques meeting the Agency for Healthcare Research and Quality definition of meditation, for participants having clinically diagnosed depressive disorders, not currently in remission, were selected. Meditation therapies were separated into praxis (i.e., how they were applied) components, and trial outcomes were reviewed. 18 studies meeting the inclusion criteria were identified, encompassing 7 distinct techniques and 1173 patients. Mindfulness-Based Cognitive Therapy comprised the largest proportion of studies. Studies including patients having acute major depressive episodes ($n = 10$ studies), and those with residual subacute clinical symptoms despite initial treatment ($n = 8$), demonstrated moderate to large reductions in depression symptoms within the group, and relative to control groups. There was significant heterogeneity of techniques and trial designs. A substantial body of evidence indicates that meditation therapies may have salutary effects on patients having clinical depressive

disorders during the acute and subacute phases of treatment. Owing to methodologic deficiencies and trial heterogeneity, large-scale, randomized controlled trials with well-described comparator interventions and measures of expectation are needed to clarify the role of meditation in the depression treatment armamentarium.

Strauss C, Cavanagh K, Oliver A, et al. **Mindfulness-based interventions for people diagnosed with a current episode of an anxiety or depressive disorder: a meta-analysis of randomized controlled trials.** PLoS One. 2014;9:e96110.

Abstract

Mindfulness-based interventions (MBIs) can reduce risk of depressive relapse for people with a history of recurrent depression who are currently well. However, the cognitive, affective and motivational features of depression and anxiety might render MBIs ineffective for people experiencing current symptoms. This paper presents a meta-analysis of randomised controlled trials (RCTs) of MBIs where participants met diagnostic criteria for a current episode of an anxiety or depressive disorder. Post-intervention between-group Hedges g effect sizes were calculated using a random effects model. Moderator analyses of primary diagnosis, intervention type and control condition were conducted and publication bias was assessed. Twelve studies met inclusion criteria ($n=578$). There were significant post-intervention between-group benefits of MBIs relative to control conditions on primary symptom severity (Hedges $g=-0.59$, 95% CI=-0.12 to -1.06). Effects were demonstrated for depressive symptom severity (Hedges $g=-0.73$, 95% CI=-0.09 to -1.36), but not for anxiety symptom severity (Hedges $g=-0.55$, 95% CI=0.09 to -1.18), for RCTs with an inactive control (Hedges $g=-1.03$, 95% CI=-0.40 to -1.66), but not where there was an active control (Hedges $g=0.03$, 95% CI=0.54 to -0.48) and effects were found for MBCT (Hedges $g=-0.39$, 95% CI=-0.15 to -0.63) but not for MBSR (Hedges $g=-0.75$, 95% CI=0.31 to -1.81). This is the first meta-analysis of RCTs of MBIs where all studies included only participants who were diagnosed with a current episode of a depressive or anxiety disorder. Effects of MBIs on primary symptom severity were found for people with a current depressive disorder and it is recommended that MBIs might be considered as an intervention for this population.

Khoury B, Lecomte T, Fortin G, et al. **Mindfulness-based therapy: a comprehensive meta-analysis.** Clin Psychol Rev. 2013;33:763-71.

Abstract

Mindfulness-based therapy (MBT) has become a popular form of intervention. However, the existing reviews report inconsistent findings. To clarify these inconsistencies in the literature, we conducted a comprehensive effect-size analysis to evaluate the efficacy of MBT. A systematic review of studies published in journals or in dissertations in PubMed or PsycINFO from the first available date until May 10, 2013. A total of 209 studies ($n=12,145$) were included. Effect-size estimates suggested that MBT is moderately effective in pre-post comparisons ($n=72$; Hedge's $g=.55$), in comparisons with waitlist controls ($n=67$; Hedge's $g=.53$), and when compared with other active treatments ($n=68$; Hedge's $g=.33$), including other psychological treatments ($n=35$; Hedge's $g=.22$). MBT did not differ from traditional CBT or behavioral therapies ($n=9$; Hedge's $g=-.07$) or pharmacological treatments ($n=3$; Hedge's $g=.13$). MBT is an effective treatment for a variety of psychological problems, and is especially effective for reducing anxiety, depression, and stress.

Kim SH, Schneider SM, Kravitz L, et al. **Mind-body practices for posttraumatic stress disorder.** J Investig Med. 2013;61:827-34.

Abstract

Mind-body practices are increasingly used to provide stress reduction for posttraumatic stress disorder (PTSD). Mind-body practice encompasses activities with the intent to use the mind to impact physical functioning and improve health. This is a literature review using PubMed, PsycINFO, and Published International Literature on Traumatic Stress to identify the effects of mind-body intervention modalities, such as yoga, tai chi, qigong, mindfulness-based stress reduction, meditation, and deep breathing, as interventions for PTSD. The literature search identified 92 articles, only 16 of which were suitable for inclusion in this review. We reviewed only original, full text articles that met the inclusion criteria. Most of the studies have small sample size, but findings from the 16 publications reviewed here suggest that mind-body practices are associated with positive impacts on PTSD symptoms. Mind-body practices incorporate numerous therapeutic effects on stress responses, including reductions in anxiety, depression, and anger, and increases in pain tolerance, self-esteem, energy levels, ability to relax, and ability to cope with stressful situations. In general, mind-body practices were found to be a viable intervention to improve the constellation of PTSD symptoms such as intrusive memories, avoidance, and increased emotional arousal. Mind-body practices are increasingly used in the treatment of PTSD and are associated with positive impacts on stress-induced illnesses such as depression and PTSD in most existing studies. Knowledge about the diverse modalities of mind-body practices may provide clinicians and patients with the opportunity to explore an individualized and effective treatment plan enhanced by mind-body interventions as part of ongoing self-care.

Meditation and the immune system

Black DS, Slavich GM. **Mindfulness meditation and the immune system: a systematic review of randomized controlled trials.** Ann NY Acad Sci. 2016;1373:13-24.

Abstract

Mindfulness meditation represents a mental training framework for cultivating the state of mindful awareness in daily life. Recently, there has been a surge of interest in how mindfulness meditation improves human health and well-being. Although studies have shown that mindfulness meditation can improve self-reported measures of disease symptomatology, the effect that mindfulness meditation has on biological mechanisms underlying human aging and disease is less clear. To address this issue, we conducted the first comprehensive review of randomized controlled trials examining the effects of mindfulness meditation on immune system parameters, with a specific focus on five outcomes: (1) circulating and stimulated inflammatory proteins, (2) cellular transcription factors and gene expression, (3) immune cell count, (4) immune cell aging, and (5) antibody response. This analysis revealed substantial heterogeneity across studies with respect to patient population, study design, and assay procedures. The findings suggest possible effects of mindfulness meditation on specific markers of inflammation, cell-mediated immunity, and biological aging, but these results are tentative and require further replication. On the basis of this analysis, we describe the limitations of existing work and suggest possible avenues for future research. Mindfulness meditation may be salutogenic for immune system dynamics, but additional work is needed to examine these effects.

Infante JR, Peran F, Rayo JI, et al. **Levels of immune cells in transcendental meditation practitioners.** *Int J Yoga.* 2014;7:147-51.

Abstract

Relationships between mind and body have gradually become accepted. Yogic practices cause modulation of the immune system. Transcendental meditation (TM) is a specific form of mantra meditation. We reported previously different plasma levels of catecholamines and pituitary hormones in TM practitioners comparing with a control group, and patterns of the daytime secretion of these hormones different from those normally described. The aim of the following study is to evaluate the immune system in these meditation practitioners, by determining leukocytes and lymphocytes subsets. TM group consisted of 19 subjects who regularly practice either TM or the more advanced Sidhi-TM technique. A control group consisted of 16 healthy subjects who had not previously used any relaxation technique. Total leukocytes, granulocytes, lymphocytes and monocytes were counted by an automated quantitative hematology analyzer, whereas lymphocytes subsets were determined by flow cytometry. Samples were taken from each subject at 0900 h after an overnight fast. The results indicated that the TM group had higher values than the control group in CD3+CD4-CD8+ lymphocytes ($P < 0.05$), B lymphocytes ($P < 0.01$) and natural killer cells ($P < 0.01$), whereas CD3+CD4+CD8- lymphocytes showed low levels in meditation practitioners ($P < 0.001$). No significant differences were observed in total leukocytes, granulocytes, monocytes, total lymphocytes or CD3+ lymphocytes comparing both groups. The technique of meditation studied seems to have a significant effect on immune cells, manifesting in the different circulating levels of lymphocyte subsets analyzed. The significant effect of TM on the neuroendocrine axis and its relationship with the immune system may partly explain our results.

Meditation and cancer patients

Boxleitner G, Jolie S, Shaffer D, et al. **Comparison of two types of meditation on patients' psychosocial responses during radiation therapy for head and neck cancer.** *J Altern Complement Med.* 2017;23:355-361.

Abstract

Radiation treatment for head and neck cancer introduces adaptive demands and subjects patients to significant and unique psychosocial challenges. There is growing evidence that meditation is useful in lessening anxiety and depression in cancer patients. This study compared the effects of two types of meditation training on the psychological responses of patients with head and neck cancer during radiation therapy. Randomized clinical trial. Smilow Cancer Hospital at Yale New Haven. A total of 29 patients with head and neck cancers were recruited and 28 patients were followed during their radiation therapy over 12 weeks. Depending on their group assignment, patients were taught one of two standardized meditations: meditation with a coach or self-meditation with a CD. Patient psychosocial responses were defined as anxiety, depression, and emotional distress and were measured by the Hospital and Anxiety Depression Scale (HADS) and the Emotional Distress Thermometer. Measures were self-reported and collected by the nurse manager at baseline and 6 and 12 weeks during the patient's scheduled weekly visit. No significant mean differences were found between the two meditation groups on all three outcomes: anxiety,

depression, and emotional distress. Patients in both the meditation with a coach and self-meditation with a CD groups reported less distress from baseline and at 6 and 12 weeks, as evidenced by the HADS anxiety scale. This study demonstrated two equally effective meditation techniques that can be implemented with patients experiencing high stress during radiation treatments in any health care setting to decrease patient anxiety, depression, and emotional distress. The data established self-meditation with a CD as a more cost-effective alternative to meditation with a coach, which requires intensive training and time commitment for patients.

Greenlee H, DuPont-Reyes MJ, Balneaves LG, et al. **Clinical practice guidelines on the evidence-based use of integrative therapies during and after breast cancer treatment.** CA Cancer J Clin. 2017;67:194-232.

Abstract

Answer questions and earn CME/CNE Patients with breast cancer commonly use complementary and integrative therapies as supportive care during cancer treatment and to manage treatment-related side effects. However, evidence supporting the use of such therapies in the oncology setting is limited. This report provides updated clinical practice guidelines from the Society for Integrative Oncology on the use of integrative therapies for specific clinical indications during and after breast cancer treatment, including anxiety/stress, depression/mood disorders, fatigue, quality of life/physical functioning, chemotherapy-induced nausea and vomiting, lymphedema, chemotherapy-induced peripheral neuropathy, pain, and sleep disturbance. Clinical practice guidelines are based on a systematic literature review from 1990 through 2015. Music therapy, meditation, stress management, and yoga are recommended for anxiety/stress reduction. Meditation, relaxation, yoga, massage, and music therapy are recommended for depression/mood disorders. Meditation and yoga are recommended to improve quality of life. Acupressure and acupuncture are recommended for reducing chemotherapy-induced nausea and vomiting. Acetyl-L-carnitine is not recommended to prevent chemotherapy-induced peripheral neuropathy due to a possibility of harm. No strong evidence supports the use of ingested dietary supplements to manage breast cancer treatment-related side effects. In summary, there is a growing body of evidence supporting the use of integrative therapies, especially mind-body therapies, as effective supportive care strategies during breast cancer treatment. Many integrative practices, however, remain understudied, with insufficient evidence to be definitively recommended or avoided. CA Cancer J Clin 2017;67:194-232. © 2017 American Cancer Society.

Ott MJ, Norris RL, Bauer-Wu SM. **Mindfulness meditation for oncology patients: a discussion and critical review.** Integr Cancer Ther. 2006;5:98-108.

Abstract

The purpose of this article is to (1) provide a comprehensive overview and discussion of mindfulness meditation and its clinical applicability in oncology and (2) report and critically evaluate the existing and emerging research on mindfulness meditation as an intervention for cancer patients. Using relevant keywords, a comprehensive search of MEDLINE, PsycInfo, and Ovid was completed along with a review of published abstracts from the annual conferences sponsored by the Center for Mindfulness in Medicine, Health Care, and Society

and the American Psychosocial Oncology Society. Each article and abstract was critiqued and systematically assessed for purpose statement or research questions, The search produced 9 research articles published in the past 5 years and 5 conference abstracts published in 2004. Most studies were conducted with breast and prostate cancer patients, and the mindfulness intervention was done in a clinic-based group setting. Consistent benefits--improved psychological functioning, reduction of stress symptoms, enhanced coping and well-being in cancer outpatients--were found. More research in this area is warranted: using randomized, controlled designs, rigorous methods, and different cancer diagnoses and treatment settings; expanding outcomes to include quality of life, physiological, health care use, and health-related outcomes; exploring mediating factors; and discerning dose effects and optimal frequency and length of home practice. Mindfulness meditation has clinically relevant implications to alleviate psychological and physical suffering of persons living with cancer. Use of this behavioral intervention for oncology patients is an area of burgeoning interest to clinicians and researchers.

Meditation and pain

Van Gordon W, Shonin E, Dunn TJ, et al. **Meditation awareness training for the treatment of fibromyalgia syndrome: A randomized controlled trial.** *Br J Health Psychol.* 2017;22:186-206.

Abstract

The purpose of this study was to conduct the first randomized controlled trial (RCT) to evaluate the effectiveness of a second-generation mindfulness-based intervention (SG-MBI) for treating fibromyalgia syndrome (FMS). Compared to first-generation mindfulness-based interventions, SG-MBIs are more acknowledging of the spiritual aspect of mindfulness. A RCT employing intent-to-treat analysis. Adults with FMS received an 8-week SG-MBI known as meditation awareness training (MAT; n = 74) or an active control intervention known as cognitive behaviour theory for groups (n = 74). Assessments were performed at pre-, post-, and 6-month follow-up phases. Meditation awareness training participants demonstrated significant and sustained improvements over control group participants in FMS symptomatology, pain perception, sleep quality, psychological distress, non-attachment (to self, symptoms, and environment), and civic engagement. A mediation analysis found that (1) civic engagement partially mediated treatment effects for all outcome variables, (2) non-attachment partially mediated treatment effects for psychological distress and sleep quality, and (3) non-attachment almost fully mediated treatment effects for FMS symptomatology and pain perception. Average daily time spent in meditation was found to be a significant predictor of changes in all outcome variables. Meditation awareness training may be a suitable treatment for adults with FMS and appears to ameliorate FMS symptomatology and pain perception by reducing attachment to self. Statement of contribution What is already known on this subject? Designing interventions to treat fibromyalgia syndrome (FMS) continues to be a challenge. There is growing interest into the applications of mindfulness-based interventions for treating FMS. Second-generation mindfulness-based interventions (SG-MBIs) are a key new direction in mindfulness research. What does this study add? Meditation awareness training - an SG-MBI - resulted in significant reductions in FMS symptomatology. SG-MBIs recognize the spiritual aspect of mindfulness and may have a role in the treatment of FMS.

Ardito RB, Pirro PS, Re TS, et al. **Mindfulness-based stress reduction program on chronic low-back pain: a study investigating the impact on endocrine, physical, and psychologic functioning.** J Altern Complement Med. 2017 May 24. [Epub ahead of print] Abstract

To explore the impact of the Mindfulness-Based Stress Reduction (MBSR) program on pain severity and endocrine, physical, and psychologic functioning in patients with chronic low-back pain (CLBP). A total of 28 participants were enrolled in the study between January and June 2014; 17 participants were sequentially sampled for an 8-week MBSR program, and 11 were placed on a waitlist control group. Pain severity, quality of life (QOL), global psychologic functioning, and depression were assessed at baseline, at the end of treatment, and 4-5 months post-treatment for both groups. Morning and evening salivary cortisol was assessed at multiple time points in participants in the MBSR group. In comparison with baseline, evening cortisol release showed a significant increase post-treatment. Significant differences between groups were found in pain severity. Medium-to-large effect sizes were found for between-group differences in both pain severity and QOL. The cortisol increase in the MBSR group is a promising finding, in the context of CLBP hypocortisolism. Data show that the effects of the MBSR treatment may take time to surface. However, due to small sample size, decisive interpretation of findings is limited. Nevertheless, the MBSR program may show promise for CLBP and should be an avenue for further investigation through larger clinical trials within healthcare systems.

Burnett, D, Phillips, G, Tashani OA. **The effect of brief mindfulness meditation on cold-pressor induced pain responses in healthy adults.** Pain Studies and Treatment 2017;5:11-19.

Abstract

We hypothesised a 10 minute mindfulness based intervention performed by a novice therapist would have a beneficial effect on pain responses in naive participants. Twenty-four participants were randomly assigned to the control group or mindfulness meditation group. The control group sat quietly for 10 minutes in between two cold pressor tasks. The mindfulness meditation intervention group practiced 10 minutes of mindfulness meditation in between cold-pressor tasks following standardised mindfulness of breathing meditation technique instructions provided by a male investigator. A significant interaction effect was found between anxiety towards pain ratings (pre-intervention vs. post-intervention) and intervention ($F = 6.29, p = 0.02$). There was a significant decrease ($t = 4.07, p = 0.002$) in anxiety towards pain ratings in the mindfulness meditation group following intervention. A significant interaction effect was found between pain threshold times (pre-intervention vs. post-intervention) and intervention ($F = 18.45, p < 0.001$). There was a significant increase ($t = -4.38, p = 0.001$) in pain threshold times in the mindfulness meditation group following intervention. A significant interaction effect was found between pain tolerance times (pre-intervention vs. post-intervention) and intervention ($F = 18.34, p < 0.001$). A significant increase ($t = -4.20, p = 0.001$) in pain tolerance times in the mindfulness meditation group following intervention was also found. The results suggest a single 10 minute mindfulness meditation intervention administered by a novice therapist can improve pain tolerance, pain

threshold and decrease anxiety towards pain in naïve healthy university aged individuals.

de Jong M, Lazar S, Hug K, et al. **Effects of mindfulness-based cognitive therapy on body awareness in patients with chronic pain and comorbid depression.** *Frontiers in Psychology.* 2016;7:967.

Abstract

Body awareness has been proposed as one of the major mechanisms of mindfulness interventions, and it has been shown that chronic pain and depression are associated with decreased levels of body awareness. We investigated the effect of Mindfulness-Based Cognitive Therapy (MBCT) on body awareness in patients with chronic pain and comorbid active depression compared to treatment as usual (TAU; N=31). Body awareness was measured by a subset of the Multidimensional Assessment of Interoceptive Awareness (MAIA) scales deemed most relevant for the population. These included: Noticing, Not-Distracting, Attention Regulation, Emotional Awareness, and Self-Regulation. In addition, pain catastrophizing was measured by the Pain Catastrophizing Scale (PCS). These scales had adequate to high internal consistency in the current sample. Depression severity was measured by the Quick Inventory of Depressive Symptomatology – Clinician rated (QIDS-C16). Increases in the MBCT group were significantly greater than in the TAU group on the ‘Self-Regulation’ and ‘Not Distracting’ scales. Furthermore, the positive effect of MBCT on depression severity was mediated by ‘Not Distracting’. These findings provide preliminary evidence that a mindfulness-based intervention may increase facets of body awareness as assessed with the MAIA in a population of pain patients with depression. Furthermore, they are consistent with a long hypothesized mechanism for mindfulness and emphasize the clinical relevance of body awareness.

Meditation and sleep

Gong H, Ni CX, Liu YZ, et al. **Mindfulness meditation for insomnia: a meta-analysis of randomized controlled trials.** *J Psychosom Res.* 2016;89:1-6.

Insomnia is a widespread and debilitating condition that affects sleep quality and daily productivity. Although mindfulness meditation (MM) has been suggested as a potentially effective supplement to medical treatment for insomnia, no comprehensively quantitative research has been conducted in this field. Therefore, we performed a meta-analysis on the findings of related randomized controlled trials (RCTs) to evaluate the effects of MM on insomnia. Related publications in PubMed, EMBASE, the Cochrane Library and PsycINFO were searched up to July 2015. To calculate the standardized mean differences (SMDs) and 95% confidence intervals (CIs), we used a fixed effect model when heterogeneity was negligible and a random effect model when heterogeneity was significant. A total of 330 participants in 6 RCTs that met the selection criteria were included in this meta-analysis. Analysis of overall effect revealed that MM significantly improved total wake time and sleep quality, but had no significant effects on sleep onset latency, total sleep time, wake after sleep onset, sleep efficiency, total wake time, ISI, PSQI and DBAS. Subgroup analyses showed that although there were no significant differences between MM and control groups in terms of total sleep time, significant effects were found in total wake time, sleep onset latency, sleep quality, sleep efficiency, and PSQI global score (absolute value of SMD range: 0.44-1.09, all $p < 0.05$). The results suggest that MM may mildly improve some sleep

parameters in patients with insomnia. MM can serve as an auxiliary treatment to medication for sleep complaints.

Maruthai N, Nagendra RP, Sasidharan A, et al. **Senior vipassana meditation practitioners exhibit distinct REM sleep organization from that of novice meditators and healthy controls.** *Int Rev Psychiatry.* 2016;28:279-87.

Abstract

Abstract/Summary The present study is aimed to ascertain whether differences in meditation proficiency alter rapid eye movement sleep (REM sleep) as well as the overall sleep-organization. Whole-night polysomnography was carried out using 32-channel digital EEG system. 20 senior Vipassana meditators, 16 novice Vipassana meditators and 19 non-meditating control subjects participated in the study. The REM sleep characteristics were analyzed from the sleep-architecture of participants with a sleep efficiency index >85%. Senior meditators showed distinct changes in sleep-organization due to enhanced slow wave sleep and REM sleep, reduced number of intermittent awakenings and reduced duration of non-REM stage 2 sleep. The REM sleep-organization was significantly different in senior meditators with more number of REM episodes and increased duration of each episode, distinct changes in rapid eye movement activity (REMA) dynamics due to increased phasic and tonic activity and enhanced burst events (sharp and slow bursts) during the second and fourth REM episodes. No significant differences in REM sleep organization was observed between novice and control groups. Changes in REM sleep-organization among the senior practitioners of meditation could be attributed to the intense brain plasticity events associated with intense meditative practices on brain functions.

Garland SN, Zhou ES, Gonzalez BD, et al. **The quest for mindful sleep: a critical synthesis of the impact of mindfulness-based interventions for insomnia.** *Curr Sleep Med Rep.* 2016;2:142-151.

Abstract

Mindfulness-Based Interventions (MBIs) for insomnia and sleep disturbances are receiving increasing clinical and research attention. This paper provides a critical appraisal of this growing area investigating the application of MBIs for people with insomnia and sleep disturbance. First, we discuss the theoretical justification for how mindfulness meditation practice may affect sleep processes. Second, we provide a focused review of literature published between January 1, 2012 and April 1, 2016 examining the impact of MBIs on sleep, broken down by whether insomnia or sleep disturbance was a primary or secondary outcome. Recommendations for future research are discussed.

Neuendorf R, Wahbeh H, Chamine I, et al. **The effects of mind-body interventions on sleep quality: a systematic review.** *Evid Based Complement Alternat Med.* 2015;2015:902708.

Abstract

Study Objectives. To evaluate the effect of mind-body interventions (MBI) on sleep. Methods. We reviewed randomized controlled MBI trials on adults (through 2013) with at least one sleep outcome measure. We searched eleven electronic databases and excluded studies on interventions not considering mind-body medicine. Studies were categorized by type of MBI, whether sleep was primary or secondary outcome measure and outcome type. Results. 1323

abstracts were screened, and 112 papers were included. Overall, 67 (60%) of studies reported a beneficial effect on at least one sleep outcome measure. Of the most common interventions, 13/23 studies using meditation, 21/30 using movement MBI, and 14/25 using relaxation reported at least some improvements in sleep. There were clear risks of bias for many studies reviewed, especially when sleep was not the main focus. Conclusions. MBI should be considered as a treatment option for patients with sleep disturbance. The benefit of MBI needs to be better documented with objective outcomes as well as the mechanism of benefit elucidated. There is some evidence that MBI have a positive benefit on sleep quality. Since sleep has a direct impact on many other health outcomes, future MBI trials should consider including sleep outcome measurements

Meditation in children and adolescents

Brown ML, Rojas E, Gouda S. **A mind-body approach to pediatric pain management.** Children (Basel). 2017;4.

Abstract

Pain is a significant public health problem that affects all populations and has significant financial, physical and psychological impact. Opioid medications, once the mainstay of pain therapy across the spectrum, can be associated with significant morbidity and mortality. Centers for Disease and Control (CDC) guidelines recommend that non-opioid pain medications are preferred for chronic pain outside of certain indications (cancer, palliative and end of life care). Mindfulness, hypnosis, acupuncture and yoga are four examples of mind-body techniques that are often used in the adult population for pain and symptom management. In addition to providing significant pain relief, several studies have reported reduced use of opioid medications when mind-body therapies are implemented. Mind-body medicine is another approach that can be used in children with both acute and chronic pain to improve pain management and quality of life.

Galla BM. **Within-person changes in mindfulness and self-compassion predict enhanced emotional well-being in healthy, but stressed adolescents.** J Adolesc. 2016;49:204-17.

Abstract

Meditation training programs for adolescents are predicated on the assumptions that mindfulness and self-compassion can be directly cultivated, and further, that doing so is beneficial for emotional well-being. Yet, very little research with adolescents has tested these assumptions directly. In the current study, I examined longitudinal relationships between changes in mindfulness and self-compassion and changes in emotional well-being among healthy, but stressed adolescents who participated in five-day, intensive meditation retreats. Immediately before and after the retreats, and then three months later, 132 adolescents (Mage = 16.76 years, 61% female) completed questionnaires measuring mindfulness, self-compassion, and emotional well-being. Repeated measures ANOVA showed adolescents improved in mindfulness, self-compassion, and all indices of emotional well-being immediately following the retreat (Cohen's $d = |0.39-1.19|$), and many of these improvements were maintained three months later (Cohen's $d = |0.04-0.68|$). Further, multilevel growth curve analyses with time-varying covariates indicated within-person changes in self-compassion predicted enhanced emotional well-being more consistently than within-person

changes in mindfulness. Specifically, increases in self-compassion predicted reductions in perceived stress, rumination, depressive symptoms, and negative affect, and conversely, increases in positive affect and life satisfaction (pseudo-R(2) variance explained = 5.9% and 15.8%, $p < 0.01$).

Perry-Parrish C, Copeland-Linder N, Webb L, et al. **Mindfulness-based approaches for children and youth.** *Curr Probl Pediatr Adolesc Health Care.* 2016;46:172-8.

Abstract

Mindfulness meditation is a useful adjunct to behavioral and medical interventions to manage a range of symptoms, including psychological and physical responses to stress, anxiety, depression, and disruptive behavior. Mindfulness approaches can be taught to children, adolescents, and their parents to improve self-regulation, particularly in response to stress. Mindfulness may be particularly relevant for youth and families who have an increased risk for exposure to chronic stress and unique stressors associated with medical and/or social-contextual considerations. Moreover, mindfulness parenting techniques can augment traditional behavioral approaches to improve children's behavior through specific parent-child interactions. A growing body of empirical studies and clinical experience suggest that incorporating mindfulness practices will enable clinicians to more effectively treat youth and their families in coping optimally with a range of challenging symptoms.

Quach D, Jastrowski Mano KE, Alexander K. **A Randomized Controlled Trial Examining the Effect of Mindfulness Meditation on Working Memory Capacity in Adolescents.** *J Adolesc Health.* 2016;58:489-96.

Abstract

To investigate the effectiveness of a mindfulness meditation intervention on working memory capacity (WMC) in adolescents via a randomized controlled trial comparing mindfulness meditation to hatha yoga and a waitlist control group. Participants ($N = 198$ adolescents) were recruited from a large public middle school in southwest United States and randomly assigned to mindfulness meditation, hatha yoga, or a waitlist control condition. Participants completed a computerized measure of WMC (Automated Operational Span Task) and self-report measures of perceived stress (Perceived Stress Scale) and anxiety (Screen for Childhood Anxiety Related Emotional Disorders) at preintervention and postintervention/waitlist. A series of mixed-design analyses of variance were used to examine changes in WMC, stress, and anxiety at preintervention and postintervention. Participants in the mindfulness meditation condition showed significant improvements in WMC, whereas those in the hatha yoga and waitlist control groups did not. No statistically significant between-group differences were found for stress or anxiety. This is the first study to provide support for the benefits of short-term mindfulness practice, specifically mindfulness meditation, in improving WMC in adolescents. Results highlight the importance of investigating the components of mindfulness-based interventions among adolescents given that such interventions may improve cognitive function. More broadly, mindfulness interventions may be delivered in an abridged format, thus increasing their potential for integration into school settings and into existing treatment protocols.

Meditation in the workplace

Van Gordon W, Shonin E, Dunn TJ, et al. **Meditation awareness training for the treatment of workaholism: a controlled trial.** J Behav Addict. 2017;20:1-9.

Abstract

Background and aims Workaholism is a form of behavioral addiction that can lead to reduced life and job satisfaction, anxiety, depression, burnout, work-family conflict, and impaired productivity. Given the number of people affected, there is a need for more targeted workaholism treatments. Findings from previous case studies successfully utilizing second-generation mindfulness-based interventions (SG-MBIs) for treating behavioral addiction suggest that SG-MBIs may be suitable for treating workaholism. This study conducted a controlled trial to investigate the effects of an SG-MBI known as meditation awareness training (MAT) on workaholism. **Methods** Male and female adults suffering from workaholism (n=73) were allocated to MAT or a waiting-list control group. Assessments were performed at pre-, post-, and 3-month follow-up phases. **Results** MAT participants demonstrated significant and sustained improvements over control-group participants in workaholism symptomatology, job satisfaction, work engagement, work duration, and psychological distress. Furthermore, compared to the control group, MAT participants demonstrated a significant reduction in hours spent working but without a decline in job performance. **Discussion and conclusions** MAT may be a suitable intervention for treating workaholism. Further controlled intervention studies investigating the effects of SG-MBIs on workaholism are warranted.

Kachan D, Olano H, Tannenbaum SL, et al. **Prevalence of mindfulness practices in the US Workforce: national health interview survey.** Prev Chronic Dis. 2017;14:E01.

Abstract

Mindfulness-based practices can improve workers' health and reduce employers' costs by ameliorating the negative effect of stress on workers' health. We examined the prevalence of engagement in 4 mindfulness-based practices in the US workforce. We used 2002, 2007, and 2012 National Health Interview Survey (NHIS) data for adults (aged ≥ 18 y, n = 85,004) to examine 12-month engagement in meditation, yoga, tai chi, and qigong among different groups of workers. Reported yoga practice prevalence nearly doubled from 6.0% in 2002 to 11.0% in 2012 (P < .001); meditation rates increased from 8.0% in 2002 to 9.9% in 2007 (P < .001). In multivariable models, mindfulness practice was significantly lower among farm workers (odds ratio [OR] = 0.42; 95% confidence interval [CI], 0.21-0.83) and blue-collar workers (OR = 0.63; 95% CI, 0.54-0.74) than among white-collar workers. Worker groups with low rates of engagement in mindfulness practices could most benefit from workplace mindfulness interventions. Improving institutional factors limiting access to mindfulness-based wellness programs and addressing existing beliefs about mindfulness practices among underrepresented worker groups could help eliminate barriers to these programs.

de Bruin EI, Formsma AR, Frijstein G, et al. **Mindful2Work: effects of combined physical exercise, yoga, and mindfulness meditations for stress relieve in employees. A proof of concept study.** Mindfulness (NY). 2017;8:204-217.

Abstract

Work-related stress and associated illness and burnout is rising in western society, with now as much as almost a quarter of European and half of USA's employees estimated to be at the point of burnout. Mindfulness meditation, yoga, and physical exercise have all shown beneficial effects for work-related stress and illness. This proof of concept study assessed the feasibility, acceptability, and preliminary effects of the newly developed Mindful2Work training, a combination of physical exercise, restorative yoga, and mindfulness meditations, delivered in six weekly group sessions plus a follow-up session. Participants ($n=26$, four males), referred by company doctors with (work-related) stress and burnout complaints, completed measurements pre and post the intervention, as well as at 6-week (FU1) and 6-month (FU2) follow-up. Results showed very high feasibility and acceptability of the Mindful2Work training. The training and trainers were rated with an 8.1 and 8.4 on a 1-10 scale, respectively, and training dropout rate was zero. Significant improvements with (very) large effect sizes were demonstrated for the primary outcome measures of physical and mental workability, and for anxiety, depression, stress, sleep quality, positive and negative affect, which remained (very) large and mostly increased further over time. Risk for long-term dropout from work (checklist individual strength [CIS]) was 92 % at pre-test, reduced to 67 % at post-test, to 44 % at FU1, and 35 % at FU2, whereas employees worked (RTWI) 65 % of their contract hours per week at pre-test, which increased to 73 % at post-test, 81 % at FU1 and 93 % at FU2. Intensity of home practice or number of attended sessions were not related to training effects. To conclude, the newly developed Mindful2Work training seems very feasible, and acceptable, and although no control group was included, the large effects of Mindful2Work are highly promising.

Yen L, Schultz A, Schnueringer E, et al. **Financial costs due to excess health risks among active employees of a utility company.** J Occup Environ Med. 2006;48:896-905.

Abstract

The objective of this study was to examine the health risk-related excess costs of time away from work, medical claims, pharmacy claims, and total costs with and without considering the prevalence of health risks. A total of 2082 of 4266 employees of a Midwest utility participated in a health risk appraisal (HRA). Individuals were classified by their HRA participation status and also by 15 health risks. Total and excess costs were analyzed for all employees. There were significant excess costs due to individual risks and overall excess health risks in all cost measures. Both excess cost per risk and prevalence of the risk were important factors in determining the excess costs in the population. As compared with low-risk participants, HRA nonparticipants and the medium- and high-risk participants were 1.99, 2.22, and 3.97 times more likely to be high cost status. Approximately one third of corporate costs in medical claims, pharmacy claims, and time away from work could be defined as excess costs associated with excess health risks.

Pauly MV, Nicholson S, Polsky D, et al. **Valuing reductions in on-the-job illness: 'presenteeism' from managerial and economic perspectives.** Health Econ. 2008;17:469-85.

Abstract

This paper reports on a study of manager perceptions of the cost to employers of on-the-job employee illness, sometimes termed 'presenteeism,' for various types of jobs. Using

methods developed previously, the authors analyzed data from a survey of more than 800 US managers to determine the characteristics of various jobs and the relationship of those characteristics to the manager's view of the cost to the firm of absenteeism and presenteeism. Jobs with characteristics that suggest unusually high cost (relative to wages) were similar in terms of their 'absenteeism multipliers' and their 'presenteeism multipliers.' Jobs with high values of team production, high requirements for timely output, and high difficulties of substitution for absent or impaired workers had significantly higher indicators of cost for both absenteeism and presenteeism, although substitution was somewhat less important for presenteeism.

Nicholson S, Pauly MV, Polsky D, et al. **Measuring the effects of work loss on productivity with team production.** Health Econ. 2006;15:111-23.

Abstract

Using data from a survey of 800 managers in 12 industries, we find empirical support for the hypothesis that the cost associated with missed work varies across jobs according to the ease with which a manager can find a perfect replacement for the absent worker, the extent to which the worker functions as part of a team, and the time sensitivity of the worker's output. We then estimate wage 'multipliers' for 35 different jobs, where the multiplier is defined as the cost to the firm of an absence as a proportion (often greater than one) of the absent worker's daily wage. The median multiplier is 1.28, which supports the view that the cost to the firm of missed work is often greater than the wage.

Michie S, Williams S. **Reducing work related psychological ill health and sickness absence: a systematic literature review.** Occup Environ Med. 2003;60:3-9.

Abstract

A literature review revealed the following: key work factors associated with psychological ill health and sickness absence in staff were long hours worked, work overload and pressure, and the effects of these on personal lives; lack of control over work; lack of participation in decision making; poor social support; and unclear management and work role. There was some evidence that sickness absence was associated with poor management style. Successful interventions that improved psychological health and levels of sickness absence used training and organisational approaches to increase participation in decision making and problem solving, increase support and feedback, and improve communication. It is concluded that many of the work related variables associated with high levels of psychological ill health are potentially amenable to change. This is shown in intervention studies that have successfully improved psychological health and reduced sickness absence.

Meditation and gastrointestinal disease

Kuo B, Bhasin M, Jacquart J et al. **Genomic and clinical effects associated with a relaxation response mind-body intervention in patients with irritable bowel syndrome and inflammatory bowel disease.** PLoS One. 2015;10:e0123861.

Abstract

Irritable Bowel Syndrome (IBS) and Inflammatory Bowel Disease (IBD) can profoundly affect quality of life and are influenced by stress and resiliency. The impact of mind-body

interventions (MBIs) on IBS and IBD patients has not previously been examined. Nineteen IBS and 29 IBD patients were enrolled in a 9-week relaxation response based mind-body group intervention (RR-MBI), focusing on elicitation of the RR and cognitive skill building. Symptom questionnaires and inflammatory markers were assessed pre- and post-intervention, and at short-term follow-up. Peripheral blood transcriptome analysis was performed to identify genomic correlates of the RR-MBI. Pain Catastrophizing Scale scores improved significantly post-intervention for IBD and at short-term follow-up for IBS and IBD. Trait Anxiety scores, IBS Quality of Life, IBS Symptom Severity Index, and IBD Questionnaire scores improved significantly post-intervention and at short-term follow-up for IBS and IBD, respectively. RR-MBI altered expression of more genes in IBD (1059 genes) than in IBS (119 genes). In IBD, reduced expression of RR-MBI response genes was most significantly linked to inflammatory response, cell growth, proliferation, and oxidative stress-related pathways. In IBS, cell cycle regulation and DNA damage related gene sets were significantly upregulated after RR-MBI. Interactive network analysis of RR-affected pathways identified TNF, AKT and NF- κ B as top focus molecules in IBS, while in IBD kinases (e.g. MAPK, P38 MAPK), inflammation (e.g. VEGF-C, NF- κ B) and cell cycle and proliferation (e.g. UBC, APP) related genes emerged as top focus molecules. In this uncontrolled pilot study, participation in an RR-MBI was associated with improvements in disease-specific measures, trait anxiety, and pain catastrophizing in IBS and IBD patients. Moreover, observed gene expression changes suggest that NF- κ B is a target focus molecule in both IBS and IBD-and that its regulation may contribute to counteracting the harmful effects of stress in both diseases. Larger, controlled studies are needed to confirm this preliminary finding.

Zernicke KA, Campbell TS, Blustein PK, et al. **Mindfulness-based stress reduction for the treatment of irritable bowel syndrome symptoms: a randomized wait-list controlled trial.** *Int J Behav Med.* 2013;20:385-96.

Abstract

Irritable bowel syndrome (IBS) is a functional disorder of the lower gastrointestinal (GI) tract affected by stress, which may benefit from a biopsychosocial treatment approach such as mindfulness-based stress reduction (MBSR).

A treatment as usual (TAU) wait-list controlled trial was conducted in Calgary, Canada to investigate the impact of MBSR on IBS symptoms. It was hypothesized that MBSR patients would experience greater reduction in overall IBS symptom severity and self-reported symptoms of stress relative to control patients. Ninety patients diagnosed with IBS using the Rome III criteria were randomized to either an immediate MBSR program (n=43) or to wait for the next available program (n=47). Patients completed IBS symptom severity, stress, mood, quality of life (QOL), and spirituality scales pre- and post-intervention or waiting period and at 6-month follow-up. Intent-to-treat linear mixed model analyses for repeated measures were conducted, followed by completers analyses. While both groups exhibited a decrease in IBS symptom severity scores over time, the improvement in the MBSR group was greater than the controls and was clinically meaningful, with symptom severity decreasing from constantly to occasionally present. Pre- to post-intervention dropout rates of 44 and 23 % for the MBSR and control groups, respectively, were observed. At 6-month follow-up, the MBSR group maintained a clinically meaningful improvement in overall IBS symptoms compared to the wait-list group, who also improved marginally, resulting in no statistically significant differences between groups at follow-up. Improvements in overall mood, QOL, and

spirituality were observed for both groups over time. The results of this trial provide preliminary evidence for the feasibility and efficacy of a mindfulness intervention for the reduction of IBS symptom severity and symptoms of stress and the maintenance of these improvements at 6 months post-intervention. Attention and self-monitoring and/or anticipation of MBSR participation may account for smaller improvements observed in TAU patients.

Ljótsson B, Andréewitch S, Hedman E, et al. **Exposure and mindfulness based therapy for irritable bowel syndrome--an open pilot study.** J Behav Ther Exp Psychiatry. 2010;41:185-90.

Abstract

We conducted a study of a group therapy based on exposure and mindfulness in the treatment of irritable bowel syndrome (IBS). Out of 49 outpatients, most of whom were referred from gastroenterological clinics, 34 entered into the 10-week treatment. Patients were assessed before, immediately after and 6 months after treatment. The assessments consisted of a gastrointestinal symptom diary, self-report questionnaires covering quality of life, gastrointestinal specific anxiety, general functioning, and a psychiatric interview. At post-treatment, the mean reduction in symptoms was 41% and 50% of patients showed clinically significant improvement in symptom level. Patients also showed marked improvement on other outcome measures. Treatment gains were maintained at follow-up. The results support the use of exposure and mindfulness based strategies in the treatment of IBS, but further randomised studies are needed to confirm the efficacy of the treatment.

Meditation and high blood pressure and cardiovascular risk

Yadav R, Yadav RK, Sarvottam K, et al. **Framingham risk score and estimated 10-year cardiovascular disease risk reduction by a short-term yoga-based life-style intervention.** J Altern Complement Med. 2017 Feb 16. [Epub ahead of print]

Abstract

The aim of this study was to evaluate the efficacy of a short-term yoga-based life-style intervention program in lowering Framingham Risk Score (FRS) and estimated 10-year cardiovascular risk. This was a single-arm, pre-post interventional study including data from a historical cohort with low to moderate risk for cardiovascular disease (CVD). It was conducted in a tertiary-care hospital. Participants with low (0 or 1 CVD risk factors) to moderately high risk (10-year risk between 10% and 20% and two or more CVD risk factors) were included. Participants with previously diagnosed CVD, defined as a history of myocardial infarction, congestive heart failure, or cerebrovascular accident, were excluded from the analysis. However, those with controlled hypertension were included. Intervention included a pretested short-term yoga-based life-style intervention, which included asanas (physical postures), pranayama (breathing exercises), meditation, relaxation techniques, stress management, group support, nutrition awareness program, and individualized advice. The intervention was for 10 days, spread over 2 weeks. However, participants were encouraged to include it in their day-to-day life. Outcomes included changes in FRS, and estimated 10-year CVD risk from baseline to week 2. A gender-based subgroup analysis was also done, and correlation

between changes in FRS and cardiovascular risk factors was evaluated. Data for 554 subjects were screened, and 386 subjects (252 females) were included in the analysis. There was a significant reduction in FRS ($p < 0.001$) and estimated 10-year cardiovascular risk ($p < 0.001$) following the short-term yoga-based intervention. There was a strong positive correlation between reduction in FRS and serum total cholesterol ($r = 0.60$; $p < 0.001$). There was a moderate positive correlation between reduction in FRS and low-density lipoprotein cholesterol ($r = 0.58$; $p < 0.001$), and a weak but positive correlation between reduction in FRS and triglycerides ($r = 0.26$; $p \leq 0.001$), serum very-low-density lipoprotein cholesterol ($r = 0.29$; $p < 0.001$), and systolic blood pressure ($r = 0.20$; $p \leq 0.001$). This yoga-based life-style intervention program significantly reduced the CVD risk, as shown by lowered FRS and estimated 10-year CVD risk. Further testing of this promising intervention is warranted in the long term.

Park SH, Han KS. **Blood pressure response to meditation and yoga: a systematic review and meta-analysis.** J Altern Complement Med. 2017 Apr 6. [Epub ahead of print]

Abstract

To introduce research that presents scientific evidence regarding the effects of mantra and mindfulness meditation techniques and yoga on decreasing blood pressure (BP) in patients who have hypertension. A literature search was performed to identify all studies published between 1946 and 2014 from periodicals indexed in Ovid Medline, EMBASE, CINAHL, PsycINFO, KoreaMed, and NDSL by using the following keywords: "hypertension," "blood pressure," "psychotherapy," "relaxation therapy," "meditation," "yoga," and "mind-body therapy." The Cochrane's Risk of Bias was applied to assess the internal validity of the randomized controlled trial studies. Thirteen studies were analyzed in this meta-analysis by using Review Manager 5.3. Among 510 possible studies, 13 met the selection criteria. Seven examined meditation, and six examined yoga. The meta-analysis indicated that meditation and yoga appeared to decrease both systolic and diastolic BP, which were within similar baseline ranges, and the reduction was statistically significant; however, some results showed little difference. After an in-depth analysis of those results, BP range and patient age were revealed as the factors that affected the different results in some reports. In particular, meditation played a noticeable role in decreasing the BP of subjects older than 60 years of age, whereas yoga seemed to contribute to the decrease of subjects aged less than 60 years. While acknowledging the limitations of this research due to the differences in BP and the participants' ages, meditation and yoga are demonstrated to be effective alternatives to pharmacotherapy. Given that BP decreased with the use of meditation and yoga, and this effect varied in different age groups, scientifically measured outcomes indicate that these practices are safe alternatives in some cases.

Kwekkeboom KL, Bratzke LC. **A systematic review of relaxation, reeducation, and guided imagery strategies for symptom management in heart failure.** J Cardiovasc Nurs. 2016;3:457-68.

Abstract

Pain, dyspnea, fatigue, and sleep disturbance are prevalent and distressing symptoms in persons with advanced heart failure. Although many lifestyle and self-care interventions have

been developed to control heart failure progression, very few studies have explored treatments exclusively for symptom palliation. Cognitive-behavioral strategies may be effective treatment for these symptoms in advanced heart failure. A systemic review was conducted to describe the effect of cognitive-behavioral strategies on pain, dyspnea, fatigue, and sleep disturbance in patients with heart failure. CINAHL, Medline, and PsychINFO were searched from inception through December 2014. Articles were selected for inclusion if they tested a cognitive-behavioral strategy using a quasi-experimental or experimental design, involved a sample of adults with heart failure, and measured pain, dyspnea, fatigue, sleep disturbance, or symptom-related quality of life. The 2 authors evaluated study quality, abstracted data elements from each study, and synthesized findings. Thirteen articles describing 9 unique studies met criteria and were included in the review. Five studies tested relaxation strategies, 3 tested meditation strategies, and 1 tested a guided imagery strategy. Of the 9 studies, 7 demonstrated some improvement in symptom outcomes. Relaxation, meditation, guided imagery, or combinations of these strategies resulted in less dyspnea and better sleep compared with attention control or usual care conditions and reduced pain, dyspnea, fatigue, and sleep disturbance within treatment groups (pretreatment to posttreatment). Symptom-related quality of life was improved with meditation compared with attention control and usual care conditions and improved pre- to post-guided imagery. Studies exploring cognitive-behavioral symptom management strategies in heart failure vary in quality and report mixed findings but indicate potential beneficial effects of relaxation, meditation, and guided imagery on heart failure-related symptoms. Future research should test cognitive-behavioral strategies in rigorously designed efficacy trials, using samples selected for their symptom experience, and measure pain, dyspnea, fatigue, and sleep disturbance outcomes with targeted symptom measures.

Klatt M, Steinberg B, Duchemin AM. **Mindfulness in motion (MIM): an onsite mindfulness based intervention (MBI) for chronically high stress work environments to increase resiliency and work engagement.** J Vis Exp. 2015;1;101.

Abstract

A pragmatic mindfulness intervention to benefit personnel working in chronically high-stress environments, delivered onsite during the workday, is timely and valuable to employee and employer alike. Mindfulness in Motion (MIM) is a Mindfulness Based Intervention (MBI) offered as a modified, less time intensive method (compared to Mindfulness-Based Stress Reduction), delivered onsite, during work, and intends to enable busy working adults to experience the benefits of mindfulness. It teaches mindful awareness principles, rehearses mindfulness as a group, emphasizes the use of gentle yoga stretches, and utilizes relaxing music in the background of both the group sessions and individual mindfulness practice. MIM is delivered in a group format, for 1 hr/week/8 weeks. CDs and a DVD are provided to facilitate individual practice. The yoga movement is emphasized in the protocol to facilitate a quieting of the mind. The music is included for participants to associate the relaxed state experienced in the group session with their individual practice. To determine the intervention feasibility/efficacy we conducted a randomized wait-list control group in Intensive Care Units (ICUs). ICUs represent a high-stress work environment where personnel experience chronic exposure to catastrophic situations as they care for seriously injured/ill patients. Despite high levels of work-related stress, few interventions have been developed and delivered onsite for such environments. The intervention is delivered on site in the ICU, during work hours, with

participants receiving time release to attend sessions. The intervention is well received with 97% retention rate. Work engagement and resiliency increase significantly in the intervention group, compared to the wait-list control group, while participant respiration rates decrease significantly pre-post in 6/8 of the weekly sessions. Participants value institutional support, relaxing music, and the instructor as pivotal to program success. This provides evidence that MIM is feasible, well accepted, and can be effectively implemented in a chronically high-stress work environment.

Bai Z, Chang J, Chen C, et al. **Investigating the effect of transcendental meditation on blood pressure: a systematic review and meta-analysis.** *J Hum Hypertens.* 2015;29:653-62.

Abstract

Some evidence from previous randomized controlled trials and systematic reviews has demonstrated a positive association between hypertension and transcendental meditation (TM). However, other trials and reviews showed the effect of TM on blood pressure (BP) was unclear but did not use subgroup analysis to rigorously investigate this relationship. The American Heart Association has stated that TM is potentially beneficial but did not give a standard indication. The present study explored several subgroup analyses in systematic reviews to investigate the effect of TM on BP. Medline, Embase, Cochrane Library, Web of Science and Chinese BioMedical Literature Database were searched through August 2014. Randomized controlled trials of TM as a primary intervention for BP were included. Two reviewers independently used the Cochrane Collaboration's quality assessment tool to assess each study's quality. Twelve studies with 996 participants indicated an approximate reduction of systolic and diastolic BP of -4.26mmHg (95% CI=-6.06, -2.23) and -2.33mmHg (95% CI=-3.70, -0.97), respectively, in TM groups compared with control groups. Results from subgroup analysis suggested that TM had a greater effect on systolic BP among older participants, those with higher initial BP levels, and women, respectively. In terms of diastolic BP, it appears that TM might be more efficient in a short-term intervention and with individuals experiencing higher BP levels. However, some biases may have influenced the results, primarily a lack of information about study design and methods of BP measurement in primary studies.

de Fátima Rosas Marchiori M, Kozasa EH, et al. **Decrease in blood pressure and improved psychological aspects through meditation training in hypertensive older adults: A randomized control study.** *Geriatr Gerontol Int.* 2015;15:1158-64.

Abstract

The present study aimed to evaluate the effects of Zen meditation on blood pressure (BP) and quality of life in elderly subjects. A total of 59 volunteers (21 men and 38 women), aged ≥ 60 years with systolic BP between 130 and 159mmHg and diastolic BP between 85 and 99mmHg, were randomly divided into a meditation group (MG), $n=28$ and a control group (CG), $n=31$. The MG meditated twice a day for 20min for 3 months, and the CG remained on a waiting list. The BP levels were measured monthly in both groups. The volunteers' medication was kept stable. A quality of life assessment instrument was applied at the beginning and end of the study. For systolic BP, analysis of variance showed the influence of time ($F(4,228) = 4.74$, $P < 0.01$, $\beta = 0.98$) and the interaction group \times time ($F(4,228) = 3.07$,

$P < 0.01$, $\beta = 0.89$). The MG showed a significant decrease in systolic BP levels in the second measurement after 1 month of meditation practice when compared with the CG (Newman-Keuls test, $P < 0.05$). Starting at the second measurement, systolic BP levels in the MG were lower than the baseline and first measurement levels; however, the systolic BP levels were similar to those observed in the CG. In the quality of life assessment evaluation, a significant improvement in psychological aspects and overall quality of life in the MG compared with the CG was observed. These results suggest that Zen meditation is an interesting tool as a complementary treatment for hypertension in elderly subjects.

Koike MK, Cardoso R. **Meditation can produce beneficial effects to prevent cardiovascular disease.** *Horm Mol Biol Clin Investig.* 2014;18:137-43.

Abstract

Coronary heart disease is the major cause of global cardiovascular mortality and morbidity. Lifestyle behaviour contributes as a risk factor: unhealthy diet, sedentary lifestyle, tobacco, alcohol, hypertension, diabetes, dyslipidemia and psychosocial stress. Atherosclerosis pathologic mechanisms involving oxidative stress, dyslipidemia, inflammation and senescence are associated with arterial wall damage and plaque formation. Stress reduction was observed in several types of meditation. After meditation, hormonal orchestration modulates effects in the central nervous system and in the body. All types of meditation are associated with blood pressure control, enhancement in insulin resistance, reduction of lipid peroxidation and cellular senescence, independent of type of meditation. This review presents scientific evidence to explain how meditation can produce beneficial effects on the cardiovascular system, and particularly regarding vascular aspects.

Byrd JB, Brook RD. **Anxiety in the "age of hypertension."** *Curr Hypertens Rep.* 2014;16:486.

Abstract

In the USA, hypertension affects one in three adults, and anxiety disorders are the most commonly diagnosed mental health disorders. Both hypertension and anxiety have been studied extensively. Yet, a full understanding of anxiety's relationship to hypertension has been elusive. In this review, we discuss the spectrum of anxiety disorders. In addition, we consider the evidence for acute and long-term effects of anxiety on blood pressure. We review the effect on blood pressure of several "real-world" stressors, such as natural disasters. In addition, we review the effect of anxiety treatments on blood pressure. We explain the American Heart Association's recent recommendations regarding meditation and other relaxation methods in the management of hypertension. We conclude that novel research methods are needed in order to better elucidate many aspects of how anxiety relates to hypertension

Dusek JA, Hibberd PL, Buczynski B, et al. **Stress management versus lifestyle modification on systolic hypertension and medication elimination: a randomized trial.** *J Altern Complement Med.* 2008;14:129-38.

Abstract

Isolated systolic hypertension is common in the elderly, but decreasing systolic blood pressure (SBP) without lowering diastolic blood pressure (DBP) remains a therapeutic

challenge. Although stress management training, in particular eliciting the relaxation response, reduces essential hypertension its efficacy in treating isolated systolic hypertension has not been evaluated. We conducted a double-blind, randomized trial comparing 8 weeks of stress management, specifically relaxation response training (61 patients), versus lifestyle modification (control, 61 patients). Inclusion criteria were ≥ 55 years, SBP 140-159 mm Hg, DBP < 90 mm Hg, and at least two antihypertensive medications. The primary outcome measure was change in SBP after 8 weeks. Patients who achieved SBP < 140 mm Hg and ≥ 5 mm Hg reduction in SBP were eligible for 8 additional weeks of training with supervised medication elimination. SBP decreased 9.4 (standard deviation [SD] 11.4) and 8.8 (SD 13.0) mm Hg in relaxation response and control groups, respectively (both $p < 0.0001$) without group difference ($p = 0.75$). DBP decreased 1.5 (SD 6.2) and 2.4 (SD 6.9) mm Hg ($p = 0.05$ and 0.01 , respectively) without group difference ($p = 0.48$). Forty-four (44) in the relaxation response group and 36 in the control group were eligible for supervised antihypertensive medication elimination. After controlling for differences in characteristics at the start of medication elimination, patients in the relaxation response group were more likely to successfully eliminate an antihypertensive medication (odds ratio 4.3, 95% confidence interval 1.2-15.9, $p = 0.03$). Although both groups had similar reductions in SBP, significantly more participants in the relaxation response group eliminated an antihypertensive medication while maintaining adequate blood pressure control.

Rainforth MV, Schneider RH, Nidich SI, et al. **Stress reduction programs in patients with elevated blood pressure: a systematic review and meta-analysis.** *Curr Hypertens Rep.* 2009;9:520-8.

Abstract

Substantial evidence indicates that psychosocial stress contributes to hypertension and cardiovascular disease (CVD). Previous meta-analyses of stress reduction and high blood pressure (BP) were outdated and/or methodologically limited. Therefore, we conducted an updated systematic review of the published literature and identified 107 studies on stress reduction and BP. Seventeen trials with 23 treatment comparisons and 960 participants with elevated BP met criteria for well-designed randomized controlled trials and were replicated within intervention categories. Meta-analysis was used to calculate BP changes for biofeedback, $-0.8/-2.0$ mm Hg ($P = \text{NS}$); relaxation-assisted biofeedback, $+4.3/+2.4$ mm Hg ($P = \text{NS}$); progressive muscle relaxation, $-1.9/-1.4$ mm Hg ($P = \text{NS}$); stress management training, $-2.3/-1.3$ mm Hg ($P = \text{NS}$); and the Transcendental Meditation program, $-5.0/-2.8$ mm Hg ($P = 0.002/0.02$). Available evidence indicates that among stress reduction approaches, the Transcendental Meditation program is associated with significant reductions in BP. Related data suggest improvements in other CVD risk factors and clinical outcomes.

Brook RD, Appel LJ, Rubenfire M, et al. **Beyond medications and diet: alternative approaches to lowering blood pressure: a scientific statement from the American Heart Association.** *Hypertension.* 2013;61:1360-83

Abstract

Many antihypertensive medications and lifestyle changes are proven to reduce blood pressure. Over the past few decades, numerous additional modalities have been evaluated in regard to their potential blood pressure-lowering abilities. However, these nondietary, nondrug treatments, collectively called alternative approaches, have generally undergone

fewer and less rigorous trials. This American Heart Association scientific statement aims to summarize the blood pressure-lowering efficacy of several alternative approaches and to provide a class of recommendation for their implementation in clinical practice based on the available level of evidence from the published literature. Among behavioral therapies, Transcendental Meditation (Class IIB, Level of Evidence B), other meditation techniques (Class III, Level of Evidence C), yoga (Class III, Level of Evidence C), other relaxation therapies (Class III, Level of Evidence B), and biofeedback approaches (Class IIB, Level of Evidence B) generally had modest, mixed, or no consistent evidence demonstrating their efficacy. Between the noninvasive procedures and devices evaluated, device-guided breathing (Class IIA, Level of Evidence B) had greater support than acupuncture (Class III, Level of Evidence B). Exercise-based regimens, including aerobic (Class I, Level of Evidence A), dynamic resistance (Class IIA, Level of Evidence B), and isometric handgrip (Class IIB, Level of Evidence C) modalities, had relatively stronger supporting evidence. It is the consensus of the writing group that it is reasonable for all individuals with blood pressure levels >120/80 mm Hg to consider trials of alternative approaches as adjuvant methods to help lower blood pressure when clinically appropriate. A suggested management algorithm is provided, along with recommendations for prioritizing the use of the individual approaches in clinical practice based on their level of evidence for blood pressure lowering, risk-to-benefit ratio, potential ancillary health benefits, and practicality in a real-world setting. Finally, recommendations for future research priorities are outlined.

Meditation in the educational system

Schwind JK, McCay E, Beanlands H, et al. **Mindfulness practice as a teaching-learning strategy in higher education: A qualitative exploratory pilot study.** Nurse Educ Today. 2017 ;50:92-96.

Abstract

Students in higher education are experiencing stress and anxiety, such that it impedes their academic success and personal wellbeing. Brief mindfulness meditation and lovingkindness meditation are two aspects of mindfulness practice that have the potential to decrease students' feelings of anxiety and stress, and increase their sense of wellbeing and capacity for compassion for self and for others. To explore how undergraduate and graduate students experience brief instructor-guided mindfulness practice; specifically, on their feelings of stress and anxiety, and their sense of wellbeing. Qualitative exploratory pilot study. Fifty-two graduate and undergraduate students in different disciplines within a community services faculty of an urban university. Brief (five-minute) instructor-guided mindfulness practices were offered over eight weeks at the beginning and end of classes. Participating students were asked to also engage in individual home practice of five to fifteen-minute mindful breathing four to five times a week and to keep a log of their experiences. At end of term, individual and group feedback (N=13) was elicited from participating students. Six of the seven instructors who guided the mindfulness practices shared their experiences of the mindfulness activities. Students reported an increased sense of calm, and a decreased feeling of anxiety. Loving kindness meditation was mostly perceived as a positive way to close the class. Their instructors also observed that the brief mindful breathing practice at start of class helped students become more grounded and focused before engaging in the course content. Challenges encountered focused on the need to provide more in-depth

information about mindfulness, as it relates to higher education teaching-learning contexts, to both students and participating instructors. Implications for education suggest further research that includes fuller experiential training of participating instructors, as well as provision of a more comprehensive background on mindfulness to students.

Mater Sociomed. Hozo ER, et al. **Burnout syndrome among educators in pre-school institutions.** 2015;27:399-403.

Abstract

The occurrence of burnout syndrome (BS) has been recognized in many professions (pilots, firefighters, police officers, doctors...) that during their work are subjected to high levels of stress. For educators in preschool institutions stress level is very high thus creating the possibility of developing BS. For this research is selected preschool institution - kindergarten "Radost" (Joy) in Split, in which by use of questionnaires (modified scale by Freudenberger and modified scales by Girdin, Everly and Dusek) during 2014 among educators (100 respondents) is conducted a survey regarding the frequency of burnout syndrome. According to questionnaires by Girdin, Everly and Dusek there is no statistically significant difference between the number of educators who feel good and those that are under significant stress ($\chi^2=1.04$; $p=0.307$). According to questionnaire by Freudenberg educators are classified into 3 categories and distribution of educators by the groups is almost uniform ($\chi^2=2.76$; $p=0.250$), which means that one third of a teacher is in good condition, a third is in the risk area for burn-out syndrome, while one third are candidates for development of this syndrome. Comparing a teacher in good condition compared to other (at risk and those who are candidates for the burn-out syndrome) is up to 1.5 times higher in those who are at risk and the candidates for development of this syndrome than in others ($\chi^2=4.5$; $p=0.033$). The occurrence of burnout syndrome is very high for the group of educators (half of the educators!) in pre-school institutions which should be taken into account by the institutions management. For this purpose, it is necessary to organize regular medical check-ups with particular reference to burnout syndrome with signs of the syndrome to prevent its further development.

Ravalier JM, Wegrzynek P, Lawton S. **Systematic review: complementary therapies and employee well-being.** Occup Med (Lond). 2016;66:428-36.

Abstract

A variety of workplace-based interventions exist to reduce stress and increase productivity. However, the efficacy of these interventions is sometimes unclear. To determine whether complementary therapies offered in the workplace improve employee well-being. We performed a systematic literature review which involved an electronic search of articles published between January 2000 and July 2015 from the databases Cochrane Central Register of Controlled Trials, PsycINFO, MEDLINE, AMED, CINAHL Plus, EMBASE and PubMed. We also undertook a manual search of all applicable article reference lists to ensure that no relevant studies were missed. We only selected published, full-length, English-language, peer-reviewed journal articles. Articles had to address the research objective using valid and reliable measures. We excluded articles concerning return to work or whose populations had been adversely affected by work resulting in the development of health issues. We included 10 articles in the review from 131 identified. Mindfulness and meditation-based interventions were most effective in improving workplace health and work

performance; the latter demonstrating some evidence of maintaining gains up to 3 months later. The evidence for relaxation interventions was inconclusive. Mindfulness and meditation interventions may be helpful in improving both psychosocial workplace health and work performance, but long-term efficacy has yet to be fully determined.

Elder C, Nidich S, Moriarty F, et al. **Effect of transcendental meditation on employee stress, depression, and burnout: a randomized controlled study.** Perm J. 2014;18:19-23. Abstract

Workplace stress and burnout are pervasive problems, affecting employee performance and personal health. To evaluate the effects of the Transcendental Meditation program on psychological distress and burnout among staff at a residential therapeutic school for students with severe behavioral problems. A total of 40 secondary schoolteachers and support staff at the Bennington School in Vermont, a therapeutic school for children with behavioral problems, were randomly assigned to either practice of the Transcendental Meditation program or a wait-list control group. The Transcendental Meditation course was provided by certified instructors. Outcome measures were assessed at baseline and four months, and included perceived stress, depression, and burnout. A multivariate analysis of covariance was used to determine overall effects. Analysis of the 4-month intervention data indicated a significant improvement in the main outcomes of the study resulting from practice of the Transcendental Meditation program compared with controls (Wilks Λ [3,28] = 0.695; p = 0.019). Results of univariate F tests indicated a significant reduction of all main outcome measures: perceived stress (F [1,32] = 13.42; p = < 0.001); depression (F [1,32] = 6.92; p = 0.013); and overall teacher burnout (F [1,32] = 6.18; p = 0.018). Effect sizes ranged from 0.40 to 0.94. The Transcendental Meditation program was effective in reducing psychological distress in teachers and support staff working in a therapeutic school for students with behavioral problems. These findings have important implications for employees' job performance as well as their mental and physical health.

Wolever RQ, Bobinet KJ, McCabe K, et al. **Effective and viable mind-body stress reduction in the workplace: a randomized controlled trial.** J Occup Health Psychol. 2012;17:246-58.

Abstract

Highly stressed employees are subject to greater health risks, increased cost, and productivity losses than those with normal stress levels. To address this issue in an evidence-based manner, worksite stress management programs must be able to engage individuals as well as capture data on stress, health indices, work productivity, and health care costs. In this randomized controlled pilot, our primary objective was to evaluate the viability and proof of concept for two mind-body workplace stress reduction programs (one therapeutic yoga-based and the other mindfulness-based), in order to set the stage for larger cost-effectiveness trials. A second objective was to evaluate 2 delivery venues of the mindfulness-based intervention (online vs. in-person). Intention-to-treat principles and 2 (pre and post) \times 3 (group) repeated-measures analysis of covariance procedures examined group differences over time on perceived stress and secondary measures to clarify which variables to include in future studies: sleep quality, mood, pain levels, work productivity, mindfulness, blood pressure, breathing rate, and heart rate variability (a measure of autonomic balance). Two hundred and thirty-nine employee volunteers were randomized into a therapeutic yoga

worksite stress reduction program, 1 of 2 mindfulness-based programs, or a control group that participated only in assessment. Compared with the control group, the mind-body interventions showed significantly greater improvements on perceived stress, sleep quality, and the heart rhythm coherence ratio of heart rate variability. The two delivery venues for the mindfulness program produced basically equivalent results. Both the mindfulness-based and therapeutic yoga programs may provide viable and effective interventions to target high stress levels, sleep quality, and autonomic balance in employees.

Meditation in healthcare

Busireddy KR, Miller JA, Ellison K, et al. **Efficacy of interventions to reduce resident physician burnout: a systematic review.** J Grad Med Educ. 2017;9:294-301.

Abstract

Studies report high burnout prevalence among resident physicians, with little consensus on methods to effectively reduce it. This systematic literature review explores the efficacy of interventions in reducing resident burnout. PubMed, Embase, and Web of Science were searched using these key words: *burnout* and *resident, intern, or residency*. We excluded review articles, editorials, letters, and non-English-language articles. We abstracted data on study characteristics, population, interventions, and outcomes. When appropriate, data were pooled using random effects meta-analysis to account for between-study heterogeneity. Study quality was assessed using Newcastle-Ottawa Scale (cohort studies) and Jadad scale (randomized control trials [RCTs]). Of 1294 retrieved articles, 19 (6 RCTs, 13 cohort studies) enrolling 2030 residents and examining 12 interventions met criteria, with 9 studying the 2003 and 2011 Accreditation Council for Graduate Medical Education (ACGME) duty hour restrictions. Work hour reductions were associated with score decrease (mean difference, -2.73; 95% confidence interval (CI) -4.12 to -1.34; $P<.001$) and lower odds ratio (OR) for residents reporting emotional exhaustion (42%; OR=0.58; 95% CI 0.43-0.77; $P<.001$); a small, significant decrease in depersonalization score (-1.73; 95% CI -3.00 to -0.46; $P=.008$); and no effect on mean personal accomplishment score (0.93; 95% CI -0.19-2.06; $P=.10$) or for residents with high levels of personal accomplishment (OR=1.01; 95% CI 0.67-1.54; $P=.95$). Among interventions, self-care workshops showed decreases in depersonalization scores, and a meditation intervention reduced emotional exhaustion.

Thimmapuram J, Pargament R, Sibliss K, et al. **Effect of heartfulness meditation on burnout, emotional wellness, and telomere length in health care professionals.** J Community Hosp Intern Med Perspect. 2017;7:21-27.

Abstract

Background: Burnout poses significant challenges during training years in residency and later in the career. Meditation is a tool to treat stress-related conditions and promote wellness. Telomere length may be affected by burnout and stress. However, the benefits of meditation have not been fully demonstrated in health care professionals. Objective: We assessed the effects of a 12-week 'Heartfulness Meditation' program on burnout, emotional wellness, and telomere length in residents, faculty members, and nurses at a large community teaching hospital during the 2015-16 academic year. Methods: All subjects completed a baseline Maslach Burnout Inventory (MBI) and Emotional Wellness Assessment (EWA) at the beginning of the study. Meditators received instructions in Heartfulness

Meditation. At week 12, subjects completed a follow up MBI and EWA scores. Salivary telomere length was measured at baseline and week 12. Results: Twenty-seven out of a total 155 residents (17.4%) along with eight faculty physicians and 12 nurses participated in the study. Thirty-five enrolled as meditators and 12 as controls. At 12 weeks, the meditators had statistically significant improvement in all measures of burnout and in nearly all attributes of EWA. Controls showed no statistically significant changes in either burnout or emotional wellness scores. Relative telomere length increased with statistical significance in a younger subset of meditators. Conclusion: Our results indicate that meditation offers an accessible and efficient method by which physician and nurse burnout can be ameliorated and wellness can be enhanced. The increased telomere length is an interesting finding but needs to be confirmed with further research.

Burgess DJ, Beach MC, Saha S. **Mindfulness practice: A promising approach to reducing the effects of clinician implicit bias on patients.** Patient Educ Couns. 2017;100:372-376. Abstract

Like the population at large, health care providers hold implicit racial and ethnic biases that may contribute to health care disparities. Little progress has been made in identifying and implementing effective strategies to address these normal but potentially harmful unconscious cognitive processes. We propose that meditation training designed to increase healthcare providers' mindfulness skills is a promising and potentially sustainable way to address this problem. Emerging evidence suggests that mindfulness practice can reduce the provider contribution to healthcare disparities through several mechanisms including: reducing the likelihood that implicit biases will be activated in the mind, increasing providers' awareness of and ability to control responses to implicit biases once activated, increasing self-compassion and compassion toward patients, and reducing internal sources of cognitive load (e.g., stress, burnout, and compassion fatigue). Mindfulness training may also have advantages over current approaches to addressing implicit bias because it focuses on the development of skills through practice, promotes a nonjudgmental approach, can circumvent resistance some providers feel when directly confronted with evidence of racism, and constitutes a holistic approach to promoting providers' well-being. We close with suggestions for how a mindfulness approach can be practically implemented and identify potential challenges and research gaps to be addressed.

Myers RE. **Cultivating mindfulness to promote self-care and well-being in perioperative Nurses.** AORN J. 2017;105:259-266. Abstract

Nursing has long been regarded as a stress-filled profession; the perioperative environment in particular is considered especially challenging. Chronic stress and burnout may have detrimental effects not only on perioperative nurses but also on their coworkers, employers, and patients. Nurses often sacrifice their own needs to care for others. Nurses must first take care of themselves, however, to sustain their optimal ability to provide care for patients. The cultivation of mindfulness is one way that perioperative nurses may promote self-care and well-being. This article discusses mindfulness and its history, the potential benefits and applications to perioperative nursing, and suggestions for cultivating mindfulness. Mindfulness research, practice, and education and the implications of mindfulness meditation in the perioperative environment are also discussed.

Chang SJ, Kwak EY, Hahm BJ, et al. **Effects of a meditation program on nurses' power and quality of life.** Nurs Sci Q. 2016;29:227-34.

Abstract

This study evaluated the effects of meditation programs on nurses' power and quality of life. In this study, Barrett's power theory derived from Rogers' unitary human being science was used as a theoretical framework. A randomized controlled design with 50 recruited and randomly allocated participants was used. The results demonstrated that the eight-week meditation program significantly improved nurses' power and quality of life. These results suggest that meditation has positive effects on power and quality of life.

Steinberg BA, Klatt M, Duchemin AM. **Feasibility of a mindfulness-based intervention for surgical intensive care unit personnel.** Am J Crit Care. 2016;26:10-18.

Abstract

Surgical intensive care unit personnel are exposed to catastrophic situations as they care for seriously injured or ill patients. Few interventions have been developed to reduce the negative effects of work stress in this environment. This pilot study evaluated the feasibility of a workplace intervention for increasing resilience to stress. The intervention was implemented within the unique constraints characteristic of surgical intensive care units. Participants were randomly assigned to an intervention or control group. The mindfulness-based intervention included meditation, mild yoga movement, and music and was conducted in a group format 1 hour a week for 8 weeks in a surgical intensive care unit during work hours. Assessments were performed 1 week before and 1 week after the intervention. The intervention was well received, with a 97% overall retention rate and 100% retention in the intervention group. Work satisfaction, measured with the Utrecht Work Engagement Scale, increased significantly in the intervention group with no change in the control group. Negative correlations were found between the vigor subscale scores of the Utrecht Work Engagement Scale and scores for emotional exhaustion on the Maslach Burnout Inventory and scores for burnout on the Professional Quality of Life scale. Participants rated recognizing their stress response as a main benefit of the intervention. Workplace group interventions aimed at decreasing the negative effects of stress can be applied within hospital intensive care units. Despite many constraints, attendance at weekly sessions was high. Institutional support was critical for implementation of this program.

Dharmawardene M, Givens J, Wachholtz A, et al. **A systematic review and meta-analysis of meditative interventions for informal caregivers and health professionals.** BMJ Support Palliat Care. 2016;6:160-9.

Abstract

Burnout, stress and anxiety have been identified as areas of concern for informal caregivers and health professionals, particularly in the palliative setting. Meditative interventions are gaining acceptance as tools to improve well-being in a variety of clinical contexts, however, their effectiveness as an intervention for caregivers remains unknown. To explore the effect of meditative interventions on physical and emotional markers of well-being as well as job satisfaction and burnout among informal caregivers and health professionals. Systematic review of randomised clinical trials and pre-post intervention studies with meditative interventions for caregivers. PubMed, EMBASE, CINAHL and PsycINFO were searched up to

November 2013. Of 1561 abstracts returned, 68 studies were examined in full text with 27 eligible for systematic review. Controlled trials of informal caregivers showed statistically significant improvement in depression (effect size 0.49 (95% CI 0.24 to 0.75)), anxiety (effect size 0.53 (95% CI 0.06 to 0.99)), stress (effect size 0.49 (95% CI 0.21 to 0.77)) and self-efficacy (effect size 0.86 (95% CI 0.5 to 1.23)), at an average of 8 weeks following intervention initiation. Controlled trials of health professionals showed improved emotional exhaustion (effect size 0.37 (95% CI 0.04 to 0.70)), personal accomplishment (effect size 1.18 (95% CI 0.10 to 2.25)) and life satisfaction (effect size 0.48 (95% CI 0.15 to 0.81)) at an average of 8 weeks following intervention initiation. Meditation provides a small to moderate benefit for informal caregivers and health professionals for stress reduction, but more research is required to establish effects on burnout and caregiver burden.

Regehr C, Glancy D, Pitts A, LeBlanc VR. **Interventions to reduce the consequences of stress in physicians: a review and meta-analysis.** J Nerv Ment Dis. 2014;202:353-9.

Abstract

A significant proportion of physicians and medical trainees experience stress-related anxiety and burnout resulting in increased absenteeism and disability, decreased patient satisfaction, and increased rates of medical errors. A review and meta-analysis was conducted to examine the effectiveness of interventions aimed at addressing stress, anxiety, and burnout in physicians and medical trainees. Twelve studies involving 1034 participants were included in three meta-analyses. Cognitive, behavioral, and mindfulness interventions were associated with decreased symptoms of anxiety in physicians (standard differences in means [SDM], -1.07; 95% confidence interval [CI], -1.39 to -0.74) and medical students (SDM, -0.55; 95% CI, -0.74 to -0.36). Interventions incorporating psychoeducation, interpersonal communication, and mindfulness meditation were associated with decreased burnout in physicians (SDM, -0.38; 95% CI, -0.49 to -0.26). Results from this review and meta-analysis provide support that cognitive, behavioral, and mindfulness-based approaches are effective in reducing stress in medical students and practicing physicians. There is emerging evidence that these models may also contribute to lower levels of burnout in physicians.