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Effectiveness of traditional meditation retreats: A systematic review and meta-analysis

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Abstract

Background: An increasing number of studies are investigating traditional meditation retreats. Very little, however, is known about their effectiveness. ***Objective:*** To evaluate the effectiveness of meditation retreats on improving psychological outcomes in general population. ***Data Sources*:** 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. ***Review Methods:*** A total of 20 papers (21 studies, $N = 2912$) were included. ***Results:*** Effect-size estimates of outcomes combined suggested that traditional meditation retreats are moderately effective in pre-post analyses ($n = 19$; Hedge's $g = .45$; 95% CI [.35, .54], $p < .00001$) and in analyses comparing retreats to controls ($n = 14$; Hedge's $g = .49$; 95% CI [.36, .61], $p < .00001$). 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. ***Conclusion***: Meditation retreats are moderately to largely effective in reducing depression, anxiety, stress and in ameliorating the quality of life of participants.

Key-words: traditional meditation retreat, Vipassana, mindfulness, compassion, meta-analysis.

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Effectiveness of traditional meditation retreats: A systematic review and meta-analysis

Meditation has been employed as a spiritual and healing practice for more than 5000 years. One of the most ancient texts dealing with meditation is the *Yoga Sutra* (1). According to the Yoga Sutras, meditation is the act of inward contemplation and the intermediate state between mere attention to an object and complete absorption within it (2). Also, the Pāli and Sanskrit term *bhāvanā* that is commonly translated as meditation translates as "cultivating" and the translation of the Tibetan equivalent *sgom* may translate as "getting used to" or "familiarizing oneself" (3). One of the most commonly cited classifications of meditation practices suggests a fundamental distinction between two main meditative styles, mindfulness meditations (MM)/open monitoring meditations and concentrative meditations (CM)/focused attention meditations, depending on how the attentional processes are directed (4, 5). While MM are characterized by open, non-judgmental awareness of the sensory and cognitive fields and include a meta-awareness or observation of the ongoing contents of thought, CM involve focused attention on a given object such as an image or a mantra, while excluding potential sources of distractions (6, 7). It is worth mentioning that both types of meditation share a common background of focused attention but they subsequently take different directions depending on the specific meditation form (5, 8, 9). Although different traditional paths place different emphasis upon MM and CM, there is general agreement that both types of meditation should be cultivated and that they could lead not only to spiritual achievements but also to significant health outcomes (e.g., 10, 11).

Taking into account the long history of traditional meditation practices and the potential benefits for health outcomes, it is surprising that up to recently, very little effort has been directed toward the clinical investigation of health outcomes derived from these traditional

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meditation practices. Indeed, most studies dealing with meditation focused on recently developed standardized mindfulness-based programs such as Mindfulness-Based Stress Reduction (MBSR; 12, 13), Mindfulness-Based Cognitive Therapy (MBCT; 14), and other meditation programs closely linked to MBSR and MBCT, such as Mindfulness-Based Relapse Prevention (MBRP; 15). Despite the considerable variation among mindfulness-based protocols, multiple systematic reviews and meta-analyses were conducted and found similar positive effects on both physical and psycho-physiological outcomes among clinical and nonclinical populations (16-24). A recent systematic review and meta-analysis of 20 systematic reviews of randomized controlled trials using the standardized MBSR or MBCT programs found significant improvements in symptoms of depression, anxiety, stress, quality of life, and physical functioning in comparison with control groups such as wait list and treatment as usual (25). Similar results were found in a review of 16 meta-analyses investigating the effects of MBSR or MBCT in clinical populations (26).

While the mechanisms of action of these modern meditation-based treatments are not yet fully understood, many authors point towards the key role of attention and emotional regulation processes in their effectiveness (e.g., 27, 28, 29). A recent mediation analysis of 20 studies found strong, consistent evidence for reduced cognitive and emotional reactivity, moderate and consistent evidence for reduced rumination and worrying, and preliminary but insufficient evidence for increased self-compassion and psychological flexibility as mechanisms underlying mindfulness-based interventions (30).

As mentioned above, although most meditation studies focused on recent standardized mindfulness-based interventions, it is worth mentioning that for centuries meditation has been primarily taught within the context of traditional spiritual paths and/or in intensive retreats,

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mainly based upon Vipassana and Shamatha practices. It is therefore surprising that up to recently, only a few studies specifically addressed this topic.

Vipassana meditation (VM), typically acknowledged as one of the main MM practices (7), is supposed to be the meditation practiced by Gautama the Buddha more than 2500 years ago and is the most ancient of Buddhist meditations (31). Literally, Vipassana means ‘‘insight”. Individuals practicing VM assume the role of an observer of their thoughts and sensations. In doing so, they learn to be less judgmental. The main aim is to remain aware in the present moment and to achieve increased equanimity and insight into the fleeting nature of the self, which, in this process, is acknowledged as an ever-changing flow of psychophysical phenomena, void of any lasting self (32). VM is currently typically taught in the West in a standardized intervention in form of a 10-day retreat as in the tradition lead by S. N. Goenka (33). Course attendees practice up to eleven hours of meditation each day and watch videotaped discourses delivered by Goenka, which explicate Buddhist views of suffering, attachment, and craving.

In Shamatha meditation (SM), typically acknowledged as one of the main CM practices (5), cognitive resources are directed toward a chosen target and away from uncontrolled, ruminative thoughts and cognitive perseverations (34). During SM, the faculty of focusing attention on a given object such as the breath without distraction is trained. Shamatha includes introductory meditation practices in the Buddhist context for the development of a relaxed, stable, and clear mind (35). Shamatha can be practiced for a few minutes daily or as an intensive meditation training - a retreat - for days, months, or even years. As the meditation practitioner engages in Shamatha practice, it is thought that he/she can progressively improve the ability to develop focused attention (5, 8).

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In addition, in several Buddhist traditions, a third form of meditation, often referred to as "non referential compassion", is frequently cultivated (36). This form of meditation aims at cultivating an intensive state of loving-kindness and can be viewed as different from mindfulness meditation. However, loving-kindness meditation shares strong resemblances with mindfulness practices. In fact, loving-kindness meditation has no specific object or focus and aims at cultivating an objectless awareness. Accordingly, it is considered by many authors and Buddhist masters as a variation of the mindfulness/OM meditation (e.g. 36).

Most of traditional meditation programs are delivered in form of a retreat based on VM, SM, or on a combination of both techniques and might include at times cultivating benevolent mental states, namely loving-kindness, compassion, empathic joy, and equanimity (34, 37). An increasing number of studies investigated these traditional meditation retreats in the last two decades. However, no meta-analysis directly examined their effectiveness so far.

Previous reviews included a few studies using intensive meditation or retreats without focusing explicitly on the effects of meditation retreats. For example, a systematic review of three clinical studies in incarcerated populations (38) found that VM reduced alcohol and substance abuse but not post-traumatic stress disorder symptoms among prisoners. A meta-analysis (18) examined meditation programs globally including transcendental meditation, mindfulness-based interventions, and traditional MM, but did not separately report outcomes of traditional MM programs. Another meta-analysis (39), which comprised both mindfulness-based interventions and traditional MM programs, included three studies on meditation retreats. Results suggested that traditional MM programs might be less effective than mindfulness-based interventions. However, this meta-analysis as other reviews did not focus explicitly on the

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effectiveness of meditation retreats, which constitute the most traditional forms of MM programs.

Objectives

To address the current gap about the effectiveness of traditional meditation retreats, we conducted a systematic review and meta-analysis of studies using traditional meditation retreats. The objectives are as follows: (1) to quantify the magnitude of the effects of retreats on psychological outcomes; (2) to quantify the change of mindfulness levels, as well as of other possible moderators of outcomes, following the retreats and at the last follow-up; and (3) to explore moderator variables of the effectiveness of the retreats.

Method

Eligibility Criteria

To be included in this meta-analysis, the publication had to meet the following criteria: (1) be published in the English language; (2) be included in the databases mentioned above; (3) include any type of traditional meditation retreat; (4) use any experimental or quasi-experimental design and (5) examine psychological outcome measures. Articles were excluded from this review due to the following criteria: (1) studies that did not evaluate the meditation program or implemented a qualitative design; (2) meditation retreat was part of a program or an intervention (e.g. MBSR); (3) they did not include psychological outcome measures; (4) data were already included in other papers comprised in the meta-analysis and thus redundant; and (5) reported data were not sufficient to compute effect sizes.

Information Sources

A systematic review of studies involving traditional meditation programs, including meditation retreats and intensive meditation was conducted. Studies were identified by searching

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PSYCINFO, PUBMED, CINAHL (Cumulative Index to Nursing and Allied Health) and Web of Science. An additional manual search involved references from retrieved articles and used Auty & Liebling and Google Scholar to access the searched papers. The time period of the search was from the first available date to October 22, 2016.

Search

We used the search terms *meditation*, *mindfulness, vipassana, or buddh** combined with *retreat* or *intensive.*

Study Selection

Eligibility assessment was performed in a non-blinded, standardized manner by the first author and was revised by the third author. Disagreements between reviewers were resolved through discussions and, when required, the authors of the original studies were contacted for clarifications.

Data Collection Process

We developed an electronic data extraction sheet, pilot-tested it on three randomly selected studies, and refined it accordingly. Data collection was conducted in December, 2015 and revised in October 2016. When duplicate reports were identified for the same data, only the most recent ones were included.

Data Items

Information was extracted from each included trial based on: (1) the characteristics of the trial (including the year of publication, research design, randomization, blinding, facilitator qualifications, number of participants, type of outcome and process measures, and follow-up time in weeks); (2) the characteristics of the meditation program (including target population, length of program in days, and compliance with the program); (3) the characteristics of the

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comparison group, in controlled studies (including the number of participants, type of control program, and length of control program when applies); and (4) the characteristics of participants (including mean age, percentage of males/females, and attrition rate).

Risk of Bias in Individual Studies

To minimize the influence of data selection, we included data pertaining to all available outcomes, including, among others, anxiety, depression, stress, emotional regulation and quality of life. Among the potential mechanisms of action, we included measures of mindfulness, compassion, and acceptance. We included data from follow-ups when such data were available.

We also included a study quality score, which was comprised of items based on Jadad's criteria for assessing the quality of reports of clinical trials (40) and others pertaining to mindfulness/meditation. The included items are adherence of the program to traditional Buddhist programs (i.e. using Vipassana, Samatha, Loving-Kindness meditation, or a combination between them); administration of measures at follow-up; use of validated mindfulness measures (i.e., MAAS, KIMS, FMI, FFMQ, SMQ, MQ, or CAMS-R, for the complete names of these scales see the note at the end of Table 1); clinical training of facilitators (i.e., psychologists, trainees in psychology or social workers); and the mindfulness training/experience of facilitators (i.e., formal meditation training). For controlled studies, the items included whether or not participants were randomized between the treatment and control groups, whether or not participants in both groups spent an equal amount of time in treatment, and whether or not evaluators or experimenters were blind regarding the treatment/control conditions and/or participants were blind regarding the study's hypotheses. For all binary items (i.e., true or false), a value of 1 was assigned if the item was true and a value of 0 if it was false. As to study design, pre-post studies were assigned a value of 0; studies with a waitlist or no-treatment control group

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were assigned a value of 1; studies with a treatment as usual (TAU) control group were assigned a value of 2; studies with an active treatment control group (other than TAU) were assigned a value of 3. For blinding, non-blinded studies were assigned a value of 0, single-blind studies were assigned a value of 1; and double-blind studies were assigned a value of 2.

The inter-rater agreement was assessed by comparing the ratings of the first author (B.K.) to the ratings of the fourth co-author (K.C.), who received a written document including specific instructions on rating the studies and one-hour training about the rating procedure.

Summary Measures

The meta-analyses were performed by computing standardized differences in means. We completed all analyses using Microsoft Excel or Comprehensive Meta-Analysis, Version 2.2.057 (CMA; 41).

Synthesis of Results

Effect sizes were computed using means and standard deviations (*SD*) when available. In the remaining studies, the effect sizes were computed using other statistics such as F, p, t, and χ^2. In within-group analyses, when the correlations between the pre- and post-treatment measures were not available, we used a conservative estimate ($r = .70$) according to the recommendation by Rosenthal (42). For all studies, Hedge's *g*, its 95% confidence interval (95% CI) and the associated z and p values were computed. To calculate the mean effect size for a group of studies, individual effect sizes were pooled using a random effect model rather than a fixed effect model, taking into account that the selected studies were not identical (i.e., did not have either an identical design or target population).

For all studies' groups, the mean Hedge's *g*, the 95% confidence interval (95% CI), and the associated p-values were computed. We systematically assessed the heterogeneity among

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studies in each group using I^2 and the chi-squared statistic (Q). I^2 measures the proportion of heterogeneity to the total observed dispersion and is not affected by low statistical power. Higgins, Thompson, Deeks, and Altman (43) suggested that an I^2 of 25% might be considered as low, 50% might be considered as moderate, and 75% might be considered as high.

Risk of Bias across Studies

To assess publication bias, we computed the fail-safe N (42) and we constructed a funnel plot.

Additional Analyses

According to the objectives of this meta-analysis, we conducted meta-regression analyses. The aim of meta-regression analyses is to assess the relationship between one or more variables (moderators) and the pooled effect size. In this meta-analysis, we included only pre-post results and we investigated five moderators: (1) mean effect size of mindfulness, (2) study quality score, (3) meditation program length (i.e., number of days), (4) mean age of participants, and (5) year of publication of the paper. Most of these variables were included in previous meta-analyses investigating the effectiveness of Western mindfulness-meditation programs (e.g. 16, 19, 20).

Results

Study Selection

PSYCINFO searches produced 805 publications, PubMed searches generated 201 publications, CINAHL searches yielded 97 publications, and Web of Science produced 355. We carefully assessed the identified publications and applied the exclusion criteria resulting in 83 publications that were thoroughly assessed. We manually added four publications that were referenced in the assessed publications, and then eliminated the publications that did not fit our

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inclusion criteria. This resulted in a final number of 20 publications (18 journal articles and two PhD dissertations; 21 studies), which were included in the analyses. The study selection process is illustrated in detail in Figure 1.

Study Characteristics

The effect size (Hedge's *g*) and other characteristics for each study are shown in Table 1. The total number of participants included in our meta-analysis was 2912. Among them, 1650 were assigned to a meditation retreat treatment and 1262 were controls.

Most studies (*n* = 16) were conducted in 2000 or later and only five were conducted prior to 2000. Most studies (*n* = 17) were conducted with general (nonclinical) populations, while four studies were conducted with prison inmates, among them one targeting inmates with substance abuse. The majority of participants were novice to meditation (*N* = 1,489; 90.24%). Almost half of the participants were female (51.13%, mean age = 40.16). The average attrition rate for six studies that reported this measure was 7.68%.

Risk of Bias within Studies

Table 1 presents the included studies and their quality scores. Of the 21 included studies, 14 studies were controlled trials, two were randomized controlled trials and the other twelve were controlled but non-randomized. Of the 14 trials with a control group, 11 compared the meditation retreat to a waitlist or no-treatment control, one compared the meditation retreat to a Roman Catholic retreat, one compared the meditation retreat to a vacation, and one compared the meditation retreat to treatment as usual (i.e., chemical dependency treatment and substance use education).

Most of the studies (*n* = 15) implemented VM. Among them, the majority (*n* = 12) used standard 10-day retreats, while one lasted nine days, one seven days, and one six days

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respectively; three studies used SM, two lasted three months (90 days), and one lasted nine days; one used a 4-day loving-kindness meditation and two used a combination among different meditation styles, one of them lasting three days and the other one lasting 28 days.

Nine studies used at least one validated mindfulness measure and three used a compassion measure. Eight included follow-up measures (average follow-up time was 19.25 weeks), two did not include post measures (i.e., only follow-up measures), two assured an equal time between treatment and control groups, and none used blind evaluators. The quality score varied from a minimum of two (lowest quality) to a maximum of eight (highest quality) with a mean of 3.81 (*SD* = 1.44) and a median of three. Inter-rater agreement (kappa = .97) was very high and comparable to previous meta-analyses (e.g. 16, 19, 20).

Results of Individual Studies

Hedge's *g* values for both clinical and mindfulness outcome measures, and at both post treatment and last follow-up, are presented in Table 1.

Synthesis of results

The effect size (Hedge's *g*) for both within-group and between-group analyses at the end of treatment and at the last follow-up and other characteristics for each study are shown in Table 1. Effect sizes, 95% confidence intervals, and heterogeneity (i.e., I^2 and Q) for both novice and experienced meditators, incarcerated individuals and general populations, different meditation retreat types (i.e., Vipassana, Samatha, loving-kindness, or a mix of meditation styles), different control groups in between-group studies (i.e., no-treatment, waitlist, Roman Catholic retreat, and stress management), outcome measures (i.e., combined psychological symptoms including anxiety, depression and stress), emotional regulation, quality of life, potential mechanisms of

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action (i.e., mindfulness, compassion, and acceptance) at both the end of treatment and at the last follow-up are available in Table 2.

Effect-size estimates of outcomes combined suggested that traditional meditation retreats are moderately effective in pre-post analyses (n = 19; Hedge's g = .45; 95% CI [.35, .54], p < .00001) and in analyses comparing retreats to controls (n = 14; Hedge's g = .49; 95% CI [.36, .61], p < .00001). Results were maintained at follow-up.

Results showed higher effects among novice meditators (n = 13; Hedge's g = .51; 95% CI [.39, .62], p < .00001) in comparison with experienced meditators (n = 6; Hedge's g = .34; 95% CI [.21, .46], p < .00001) in pre-post analyses. Similar results were also obtained in controlled analyses. Due to these large differences in effect sizes between novice and experienced meditators and in order to decrease homogeneity among studies, we conducted sub-analyses separately for the studies with novice meditators and the ones with experienced meditators.

Results from sub-analyses in studies with novice meditators suggested large effects on psychological symptoms, namely anxiety, depression, and stress in pre-post analyses (n = 7; Hedge's g = .79; 95% CI [.47, 1.10], p < .00001) and controlled analyses (n = 4; Hedge's g = .97; 95% CI [.34, 1.61], p < .00001). However, heterogeneity was high in both pre-post and between-group analyses, suggesting caution in drawing definitive conclusions. Effects were also larger among the general population samples as compared with incarcerated individuals. A study targeted substance abuse among incarcerated population showing a moderate effect size of a 10-day VM retreat in comparison with treatment as usual (mainly through psycho-education about substance use), Hedge's g = .55; 95% CI [.10, 1.01], p < .05. In both within-group and between-group analyses, effect sizes were large for measures of mindfulness and compassion, moderate

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for measures of acceptance, moderate to large for measures of quality of life, and small to moderate for measures of emotional regulation.

In between-group analyses among studies with novice meditators, the effects were larger in studies comparing meditation retreats to a no-treatment control group (n = 5; Hedge's g = .78; 95% CI [.34, 1.22], p < .001), followed by a study comparing meditation retreats to a Roman Catholic retreat (n = 1; Hedge's g = .61; 95% CI [.45, .78], p < .00001), then studies comparing meditation retreats with waitlist controls (n = 3; Hedge's g = .57; 95% CI [.45, .69], p < .00001), and finally a study comparing meditation retreats to a stress management intervention (n = 1; Hedge's g = .53; 95% CI [.25, .82], p < .0005). In both within-group and between-group analyses, effects were maintained at follow-up with moderate effects for psychological symptoms and large effects for mindfulness and compassion measures.

Results from sub-analyses in studies with experienced meditators (average meditation experience = 14.31 years, SD = 1.83) were not significant for psychological symptoms in pre-post analyses (n = 3; p = .14) and controlled analyses (n = 3; p = .35). Effects were moderate to large on mindfulness among experienced meditators in pre-post analyses (n = 4; Hedge's g = .70; 95% CI [.42, .98], p < .00001) and not significant in controlled analyses (n = 2; p = .20).

Risk of Bias across Studies

The effect size for all pre-post analyses corresponded to a z value of 26.77 (p < .00001) indicating that 3,527 studies with a null effect size would be needed to nullify our results (i.e., for the two-tailed p value to exceed .05). The Trim and Fill method suggested that the plot is symmetric and that no studies had to be added (see Figure 2). Similar results were obtained for controlled studies, with a z value of 13.58 (p < .00001) and a corresponding fail-safe N of 659.

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Similarly to pre-post analyses, the plot was symmetric and suggested that no studies had to be added. These analyses suggest that the effect-size estimates were unbiased and robust.

Additional analyses

At the end of treatment, the average pre-post effect size of clinical outcomes was strongly positively moderated by the effects of mindfulness outcomes (n = 8; β = .71, SE = .22, p < .005) (Figure 3) and very weakly positively moderated by the year of publication (n = 13; β = .007, SE = .0028, p < .01). The average pre-post effect size was not moderated by the retreat duration (p = .52, ns), the study quality score (p = .55, ns), and the mean age of participants (p = .55, ns). At follow-up, due to the limited number of studies, none of the moderators was statistically significant.

Discussion

Summary of evidence

This meta-analysis examined 20 papers (21 studies) of meditation retreats for a combined total of 2912 participants. The results showed that traditional meditation retreats were moderately effective for improved psychological outcomes in healthy populations in both within-group and between-group analyses (i.e., in comparison to a waitlist or to an active treatment). Three studies compared meditation retreats to active treatments; the effect sizes were small to moderate but cannot be generalized due to the limited number of studies and the differences among the control treatments (i.e., stress management, Roman Catholic retreat and vacation). Effects were larger for novice meditators in comparison with experienced ones, possibly because of a floor effect in expert meditators. The effects were also larger among general populations in comparison with incarcerated individuals. No differences were observed among different meditation retreats styles (e.g., Vipassana versus Shamatha).

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Even though meditation retreats did not target a clinical population nor were they aimed at reducing symptoms, large effects were observed on clinical measures, namely depression and anxiety among novice meditators. A significant reduction of stress, an increase of emotional regulation, life quality and process measures of acceptance, compassion, and mindfulness were likewise observed. Effects were maintained at follow-up even though they were moderate. These results are comparable to the ones obtained in the meta-analysis conducted by Eberth and Sedlmeier (39), which included three studies on traditional meditation retreats.

In addition, the average attrition rate among participants in the selected studies (7.7 %) was smaller than the attrition rate observed in meta-analyses examining mindfulness-based treatments (e.g., 17 % in MBSR for healthy individuals; 20). These results suggest a higher commitment among participants to meditation retreats. However, these results were expected as most trials were not randomized, the majority of participants in the meditation retreats were self-selected, and participants usually pay a considerable fee to participate in a retreat.

When interpreting the findings of this meta-analysis, it is important to consider that even though all studies included a meditation retreat, they varied in implementing the retreat as some comprised Vipassana practice while others used Shamatha meditation, loving-kindness, or a combination of different meditation styles. The duration of the retreat also greatly varied from a minimum of three days to a maximum of 90 days, even though most of the studies (i.e., 15) included a retreat of seven to ten days. The target populations likewise varied among the studies as some were conducted with the general population while others targeted incarcerated individuals, and some had novice meditators while others had more experienced meditators. In addition, studies measured different variables using different scales. This diversity in study designs, outcomes and target population may have been a large contributor to the heterogeneity

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observed in effect sizes in the current meta-analysis. However, despite this heterogeneity, results support significant and large reductions of stress, anxiety, and depression in seven within-groups and four between-group trials.

One obvious question is whether participating in a meditation retreat also produces positive changes on measures of mindfulness. Surprisingly, less than half of the studies (i.e., 43 %) included a validated measure of mindfulness. The results showed that following a meditation retreat, participants perceived themselves as more mindful in comparison with baseline, and that gains were maintained at the last follow-up. These gains were larger for novice meditators in comparison with experienced ones. In addition, mindfulness levels of participants predicted 50% of the amelioration on clinical outcomes. In the three studies that reported a compassion measure, participants perceived themselves as more compassionate at endpoint in comparison with baseline. Due the limited number of studies reporting compassion, we were not able to verify whether compassion is a moderator of outcome measures.

Our results showed that the study quality score did not moderate the efficacy of meditation retreats. These results are consistent with meta-analyses of mindfulness-based treatments (e.g., 16, 20, 44, 45). However, a negative but weak moderation of the study quality score was found in a previous large meta-analysis (i.e., 19). The low quality of the studies might explain the absence of moderation in the current meta-analysis. The duration of the retreat also did not moderate its effectiveness. The low variability in retreat duration among the included studies, of which the majority used the standard 10-day format, might explain the absence of moderation. The mean age of participants was also not a significant moderator of effect size. Finally, the year of publication was a very weak moderator of the effectiveness of the meditation retreats, suggesting that more recent studies had slightly higher effects than older ones. There is

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no specific explanation of this moderation and its extreme small size practically nullifies its impact on the outcomes measures (predicts less than 0.005 % of the amelioration on clinical outcomes).

Limitations

Limitations of this meta-analysis comprise the limited number of included studies and the high heterogeneity among some study groups, reducing as a consequence the specificity of the obtained results. Furthermore, the assessed outcomes varied widely from study to study. Due to the limited number of available studies, we also inevitably included studies with different levels of quality, which we quantified via the study quality score and included in the analyses. To address our own expectancy bias, we implemented liberal selection criteria and included a variety of studies. From a clinical perspective, intensive and unsupervised meditation as delivered in meditation retreats is counter indicated for some clinical populations, namely for patients with psychotic disorders or panic disorder as intensive meditation might increase psychotic symptoms or trigger a panic attack (48, 49). Therefore, individuals with a psychotic disorder, panic disorder, or other severe mental illness should be discouraged from participating in meditation retreats, thereby limiting the scope of meditation retreats to a healthy population, individuals with mild to moderate mental disorders and individuals with medical conditions.

Conclusions

Despite the limitations, our results showed that meditation retreats are moderately to largely effective, specifically for symptoms of stress, anxiety, and depression among a healthy population. In addition, the findings suggest that increases in mindfulness might be a central component of the retreats' effectiveness. These results have important clinical implications and might encourage individuals with mild to moderate symptoms of stress, anxiety, or depression to

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engage in intensive meditation, namely in forms of retreats. These results are particularly encouraging to novice meditators as they show better outcomes than experienced ones. However, some of these results are still preliminary and need to be repeated to verify their effectiveness among healthy population and individuals with psychological disorders or medical conditions. Therefore, we recommend conducting methodologically rigorous studies to establish the efficacy of meditation retreats in comparison with other types of retreats. In addition, it is recommended that future studies include at least one validated measure of mindfulness and one measure of compassion as they are considered to be central components of meditation retreats.

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Figure Captions

Figure 1. Flow diagram of the study selection process.

Figure 2. Funnel plot of precision by Hedge's g for pre-post data.

Figure 3. Relationship between mindfulness outcome effect sizes and clinical outcome effect sizes at the end of treatment for pre-post data. The circles represent the studies; their diameter is proportional to the study weight (i.e. to the ratio of the number of participants of the specific study to the total number of participants for the present meta-analysis).

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Table 1.

Description and Effect Size Analyses of the Efficacy of the selected Studies

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measure)	Pre-Post *g*(*gm*)	Fup wks	PreFup *g*(*gm*)	Cntrl *g* post (gm)	Cntrl *g* fup (gm)	Sc
Adhikari, 2012	Individuals enrolled in a VM course (40)	23.0	54.8	VM (40)	N/A	N/A	22.5	10	BAI; BDI-II	.43	-	-	-	-	2
Al-Hussaini et al., 2001	Tx: Individuals enrolled in a VM course (14) Cntrl: University students (31)	Tx: 40.14 Cntrl: 19.77	Tx: 50.0 Cntrl: 54.84	VM (14)	Cntrl (31)	no	0	10	GHQ-28; HADS	2.61	-	-	2.21	-	2
Bowen et al., 2006	Incarcerated inmates (305)	Tx+Cntrl 37.48	Tx+Cntrl 20.8	VM (63)	TAU (242)	no	9.5	10	DDQ;DDTQ; SIP; DIC-15; DRLOCS-28; WBSI; BSI; LOT	-	13	.60	-	.55	5

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Table 1. *(continued).*

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measures)	Pre-Post *g*(*gm*)	Fup wks	PreFup *g*(*gm*)	Cntrl *g* post (gm)	Cntrl *g* fup (gm)	Sc
Chambers et al., 2008	Tx: Novice meditators enrolled in a VM course (20) Cntrl: University students (20)	Tx: 33.7 Cntrl: 31.9	Tx: 45.0 Cntrl: 55.0	VM (20)	Cntrl (20)	no	-	10	RRS; BDI; BAI; PANAS; DSB; IST; (MAAS)	.56 (.72)	-	-	.56 (.98)	-	3
Chandiramani et al., 1995 (study 1)	Incarcerated inmates (120)	-	0	VM (120)	N/A	N/A	-	10	HAI; MDI; HS; HDHQ; PEN	.48	13	.32	-	-	3
Chandiramani et al., 1995 (study 2)	Incarcerated inmates (150)	-	0	VM (85)	Cntrl (65)	no	-	10	BDI; BAI; SOA; ATLS; PTI; DPT	.26	13	.34	.28	.12	4

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Table 1. *(continued).*

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measures)	Pre-Post *g*(*gm*)	Fup wks	PreFup *g*(*gm*)	Cntrl *g* post (gm)	Cntrl *g* fup (gm)	Sc
Choi et al., 2012	Tx: Experienced mediators (10) Cntrl: non-mediators (10)	Tx: - Cntrl: -	Tx: 40.0 Cntrl: 40.0	VM (10)	Cntrl (10)	no	-	10	FEE	.55	-	-	1.00	-	3
Emavardhana & Tori (1997)	Tx: Youths enrolled in a VM course (438) Cntrl: Students (281)	Tx= 18.03 Cntrl=18.11	Tx= 62.33 Cntrl = 61.0	VM (438)	Cntrl (281)	No	0	7	TSCS; LSI; BBPS	.25	-	-	.48	-	3
Falkenström (2010)	Experienced meditators (76)	Tx= 48.5 Cntrl=46.8	Tx= 56.0 Cntrl = 75.0	VM (48)	Cntrl (28)	no	-	6	GP-CORE (KIMS; FFMQ)	.17 (.37)	-	-	.40 (.11)	-	4

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Table 1. *(continued).*

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measures)	Pre-Post *g*(*gm*)	Fup wks	PreFup *g*(*gm*)	Cntrl *g* post (*gm*)	Cntrl *g* fup (*gm*)	Sc
Jacobs et al., 2011	Participants enrolled in a SM retreat (60)	Tx: 48.0 Cntrl: 48.0	Tx: 53.33 Cntrl: 53.33	SM (30)	WL (30)	Yes	-	90	WBS; BFI; (FFMQ)	.21 (.70)	20	-	.42 (.62)	-	6
Jacobs et al., 2013	Participants enrolled in a SM retreat (60)	Tx: 48.0 Cntrl: 48.0	Tx: 46.66 Cntrl: 46.66	SM (30)	WL (30)	Yes	-	90	BMI (FFMQ)	.16 (.79)	-	-	-	-	5
Khurana & Dhar, 2000	Incarcerated inmates (238)[1]	Tx: - Cntrl: -	Tx: 24.19 Cntrl: 26.32	VM (124)	Cntrl (114)	No	-	10	SWB; CP	.17	-	-	.49	-	3
Kozasa et al., 2015	Novice and experienced meditators enrolled in a SM retreat (67)	44.14	61.36	SM (67)	N/A	N/A	-	9	SCS; DST; (MAAS)	.71 (.92)	-	-	-	-	3

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Table 1. *(continued).*

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measures)	Pre-Post *g*(*gm*)	Fup wks	PreFup *g*(*gm*)	Cntrl *g* post (*gm*)	Cntrl *g* fup (*gm*)	Sc
Krygier et al., 2013	Participants enrolled in a VM course (36)	43.8	55.55	VM (36)	N/A	N/A	-	10	SWLS; PANAS; DASS-21; (MAAS) EQ; AAQ-II; POMS;	.62 (.91)	-	-	-	-	3
Orzech et al., 2009	Community adults (69)	Tx+Cntrl 53.3	Tx+Cntrl 71.0	MM (36)	WL (33)	No	-	30	PANAS; SWLS; SCS (MASS; FMI)	.42 (.90)	4	.45 (.87)	.12 (.91)	-	4
Ostafin et al., 2006	Participants enrolled in a VM course (128)	40.40	49.06	VM (128)	N/A	N/A	-	10	BSI; SDS	-	13	.44	-	-	3

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Table 1. *(continued).*

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measures)	Pre-Post *g*(*gm*)	Fup wks	PreFup *g*(*gm*)	Cntrl *g* post (gm)	Cntrl *g* fup (gm)	Sc
Perelman et al., 2012	Incarcerated inmates (127)	Tx+Cntrl 35.4	Tx+Cntrl 0	VM (60)	HOH (67)	No	5	10	NAI-25; POMS-SF; TMMS; (CAMS-R)	.21 (2.64)	52	.37 (1.09)	.00 (2.27)	.22 (.10)	8
Sterling, 1996	Tx: VM retreat meditators (47) Cntrl: community adults (32)	Tx: 47.32 Cntrl: 38.16	Tx: 75.0 Cntrl: 75.0	VM (47)	Cntrl (32)	No	-	10	POMS; ACL; ABS	.09	-	-	.17	-	3
Szekeres & Wertheim (2014)	Participants enrolled in a VM course (172)	Tx+Cntrl 39.9	Tx+Cntrl 70.9	VM (122)	WL (50)	No	-	10	DASS; WBI-5; SCS; AAQ; SDS; (FMI)	.73 (.79)	26	.50 (.59)	.70 (.76)	-	5

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Table 1. *(continued).*

Study	Type Participants (*N*)	M. Age	% Female	Tx Group (*n*)	Comp. Group (*n*)	Rnd Ass	% Att	Tx days	Outcome Measures (Mind. Measures)	Pre-Post *g*(*g*m)	Fup wks	PreFup *g*(*g*m)	Cntrl *g* post (gm)	Cntrl *g* fup (gm)	Sc
Tori, 1999	Adolescent girls (306)	Tx 1: 16.2 Tx 2: 16.2 Cntrl: 16.2	Tx 1: 100 Tx 2: 100 Cntrl: 100	BR (102)	RC (102)	No	-	3	ACL	.62	-	-	.50	-	5
Wong Oi Chi, 2011	LKM retreat meditators (30) Vacationing adults (25)	Tx: 41.93 Cntrl: 39.24	Tx: 80.0 Cntrl: 52.0	LKM (30)	Cntrl (25)	No	9.09	4	POMS-SF; BCHI; MLQ; SCS;	.45	-	-	.34	-	3

Note. Treatment and control groups: Att = Attrition; Cntrl = Control; Comp. = Comparison; Fup = Follow-up; *g* = Hedge's g of clinical outcomes; *g*m = Hedge's g of Mindfulness and/or Compassion outcomes; M = Mean; Mind = Mindfulness; Rnd Ass = Random Assessment; Sc = Quality Score; Tx = Treatment; Tx+Cntrl = Treatment and Control; wks = weeks Interventions and conditions: BR = Buddhist Retreat; CR = Catholic Retreat; [1]combined many studies with similar population and designs; HOH = Houses of Healing; LKM = Loving Kindness Meditation; MM = Mixed Mindfulness Meditation Retreat; N/A = Not applicable; SM = Shamatha Meditation; TAU = Treatment as Usual; VM = Vipassana; WL = Wait-list; Outcome

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measures: AAQ = Acceptance and Action Questionnaire; AAQ-II = Acceptance and Avoidance Questionnaire-II; ABS = Affects Balance Scale; ACL = Adjective Check List; ATLS = Attitude to Law Scale; BAI = Beck Anxiety Inventory; BBPS = Buddhist Beliefs and Practices Scale; BCHI = Brief Chinese Happiness Inventory; BDI = Beck Depression Inventory; BDI-II = Beck Depression Inventory-II; BFI = Big Five Inventory; BMI = Body Mass Index; BSI = Brief Symptom Inventory; CAMS-R = Cognitive and Affective Mindfulness Scale Revised; CP = Criminal Propensity Scale; DASS = Depression and Anxiety Stress Scale; DASS-21 = The Depression, Anxiety and Stress 21-item Scales; DDTQ = Daily Drug-Taking Questionnaire; DDQ = Daily Drinking Questionnaire; DIC-15 = Drinker Inventory of Consequences 15-item Scale; DPT = Draw a Person Test; DRLOCS-28 = Drinking-Related Locus of Control 28-item Scale; DSB = Digit Span Backward subscale; DST = Digit-Symbol Test; EQ = Experiences Questionnaire; FEE = Facial Emotional Expression; FFMQ = Five Factor Mindfulness Questionnaire; FMI = Freiburg Mindfulness Inventory; GHQ-28 = General Health Questionnaire 28-item Scale; GP-CORE = Clinical Outcomes in Routine Evaluation-General Population; HADS = the Hospital Anxiety and Depression; HAI = Hamilton Anxiety Inventory; HDHQ = Hostility and Direction of Hostility Questionnaire; HS = Miller and Power Hope Scale; IST = Internal Switching Task; KIMS = Kentucky Inventory of Mindfulness Skills; LOT = Life Orientation Test; LSI = Life Style Index; MAAS = Mindful Attention Awareness Scale; MDI = Montgomery Depressive Inventory; MLQ = Meaning in Life Questionnaire; NAI-25 = Novaco Anger Inventory-Short Form; PANAS = Positive and Negative Affect Schedule; PEN = Psychoticism, Extraversion, and Neuroticism Inventory; POMS = Profile of Moods States; POMS-SF = Profile of Mood States-Short Form; PTI = Personality Trait Inventory; RRS = Ruminative Response Scale; SCS = Self Compassion Scale; SDS = Marlowe-Crowne Social

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Desirability Scale; SIP = Short Inventory of Problems; SOA = Scale of Anomie; SWB = Subjective Well-Being Scale; SWLS = Satisfaction with Life Scale; TMMS = Trait Meta-Mood Scale; TSCS = Tennessee Self Concept Scale; WBI-5 = Who (*five*) Well-Being Index; WBS = Well-Being Scale; WBSI = The White Bear Suppression Inventory.

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Table 2.

Effect sizes and other statistics for different groups of studies at different time points

Study design	Time point	Division criteria	Studies group	*Ns*	*g*	95% CI	*p*	I^2(%)	*Q*
Within-group (pre-post analyses)	End of Tx	-	All	19	.45	[.35, .54]	< .00001	88.06	150.74
		Novice to meditation	Yes	13	.51	[.39, .62]	< .00001	86.32	87.73
			no	6	.34	[.21, .46]	< .00001	79.87	24.84
		Target population	general population	10	.54	[.40, .69]	< .00001	88.62	79.10
			incarcerated individuals	3	.44	[.35, .53]	< .00001	11.0	2.25
		meditation retreat	Vipassana	11	.49	[.36, .63]	< .00001	86.67	75.03
			Samatha	1	.44	[.29, .59]	< .00001	-	-
			Other	1	.70	[.60, .79]	< .00001	-	-
		outcomes	psychological symptoms	7	.79	[.47, 1.10]	< .00001	85.19	40.51
			- *anxiety*	6	.93	[.37, 1.48]	< .005	92.96	70.99
			- *depression*	5	.87	[.55, 1.20]	< .00001	70.29	13.46
			- *stress*	2	1.01	[.61, 1.40]	<.00001	77.38	4.42
			emotional regulation	4	0.44	[.24, .64]	<.00001	63.39	8.19

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Table 2. *(continued)*.

Study design	Time point	Division criteria	Studies group	*Ns*	*g*	95% CI	*p*	I^2(%)	*Q*
			quality of life	4	.50	[.35, .65]	< .00001	52.56	6.32
		Potential mechanisms of action	mindfulness	5	1.13	[.68, 1.59]	< .00001	92.72	54.92
			compassion	2	.77	[.58, .96]	< .00001	64.28	2.80
			acceptance	1	.40	[.26, .55]	< .00001	-	-
	Fwp	-	psychological symptoms	3	.50	[.37, .64]	< .00001	4.45	2.09
			mindfulness	2	.82	[.34, 1.31]	< .001	86.20	7.25
Between-group	End of Tx	-	All	14	.49	[.36, .61]	< .00001	65.18	37.33
		Novice to meditation	Yes	10	.59	[.46, .73]	< .00001	55.44	20.20
			No	4	.26	[.13, .39]	< .0005	.00	.58
		control group type	no-treatment	5	.78	[.34, 1.22]	< .001	78.67	18.76
			waitlist controls	3	.57	[.45, .69]	< .00001	.00	.99
			Roman Catholic retreat	1	.61	[.45, .78]	< .00001	-	-
			stress management	1	.53	[.25, .82]	< .0005	-	-

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Table 2. *(continued)*.

Study design	Time point	Division criteria	Studies group	*Ns*	*g*	95% CI	*p*	I^2(%)	*Q*
		Target population	general population	8	.62	[.46, .77]	< .00001	64.07	19.48
			incarcerated individuals	2	.50	[.23, .77]	< .0005	.00	.41
		meditation retreat	Vipassana	8	.63	[.44, .82]	< .00001	63.70	19.28
			Samatha	1	.47	[.21, .72]	< .0005	-	-
			Other	1	.61	[.45, .78]	< .00001	-	-
		outcomes	psychological symptoms	4	.97	[.34, 1.61]	< .005	77.53	13.35
			- *anxiety*	3	1.60	[-.27, 3.47]	.09, ns	94.35	35.38
			- *depression*	2	1.25	[.78, 1.73]	< .00001	.00	.04
			- *stress*	1	.84	[.50, 1.18]	<.00001	-	-
			emotional regulation	3	.23	[-.10, .56]	.17, ns	17.87	2.44
			quality of life	3	.58	[.34, .82]	< .00001	.00	.09
		Potential mechanisms of action	Mindfulness	4	1.14	[.46, 1.82]	< .005	86.25	21.81
			compassion	2	.70	[.39, 1.01]	< .00001	51.18	2.05
	Fwp	-	psychological symptoms	2	.43	[.05, .81]	< .05	.38	1.00
			mindfulness	1	.27	[-.43, .64]	.71, ns	-	-

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Note. Ns = Number of studies; Tx = Treatment; Fwp = Follow-up. Please note that in pre-post analyses we were to compute mean effect sizes from 19 studies as two did not provide sufficient data to compute pre-post effect sizes.

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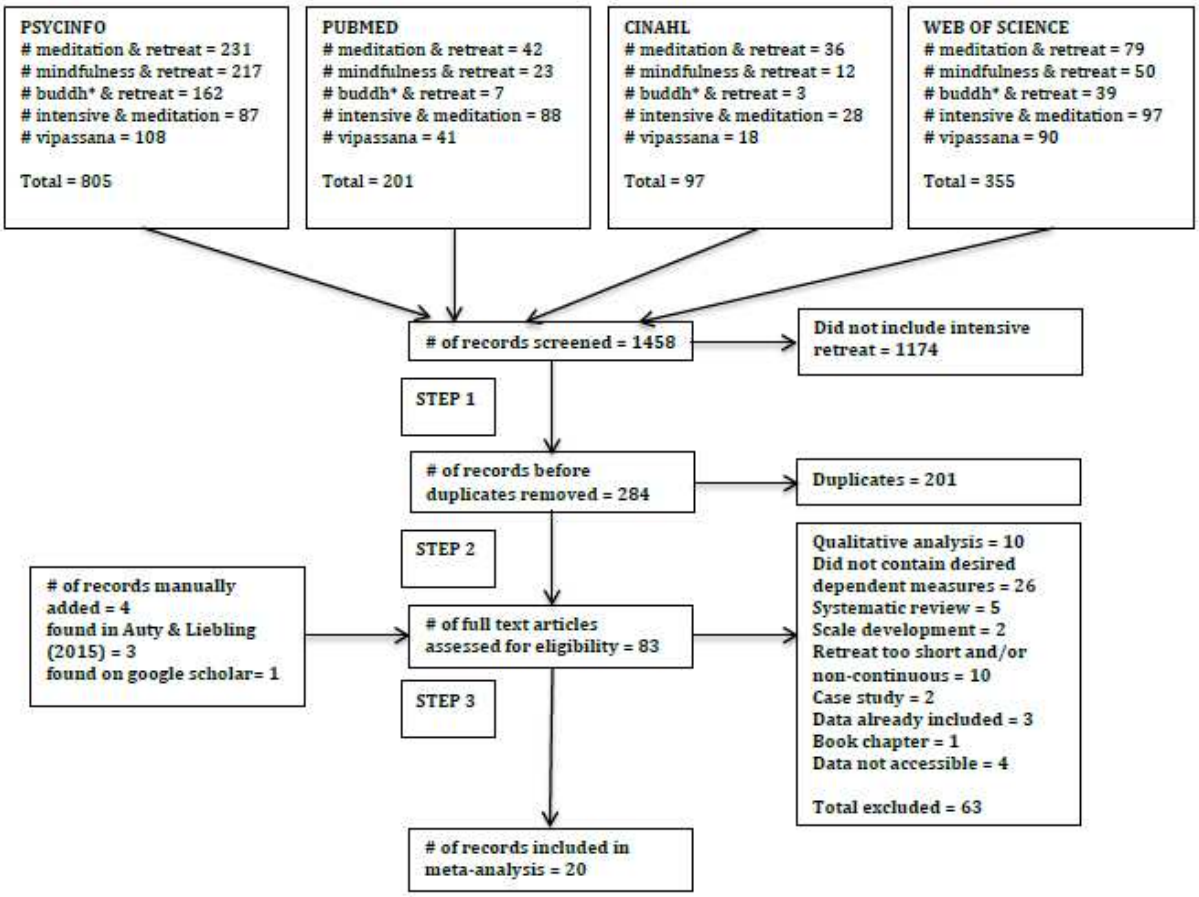

Fig. 1

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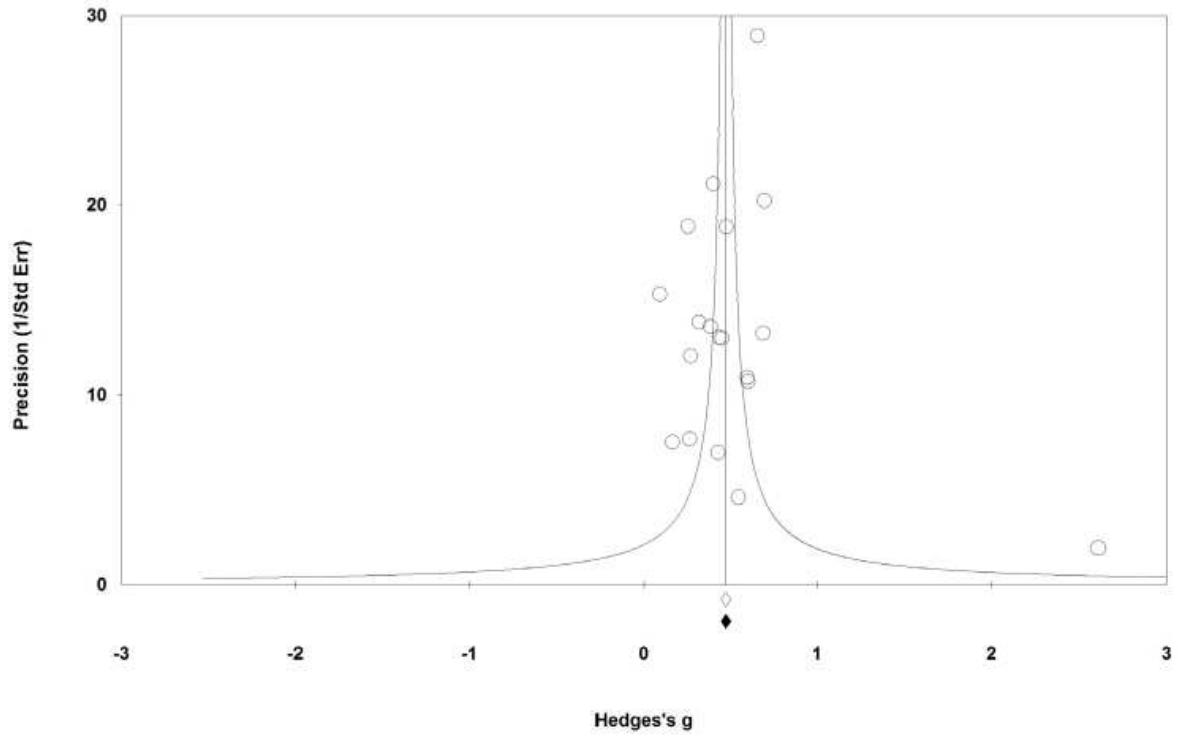

Fig. 2

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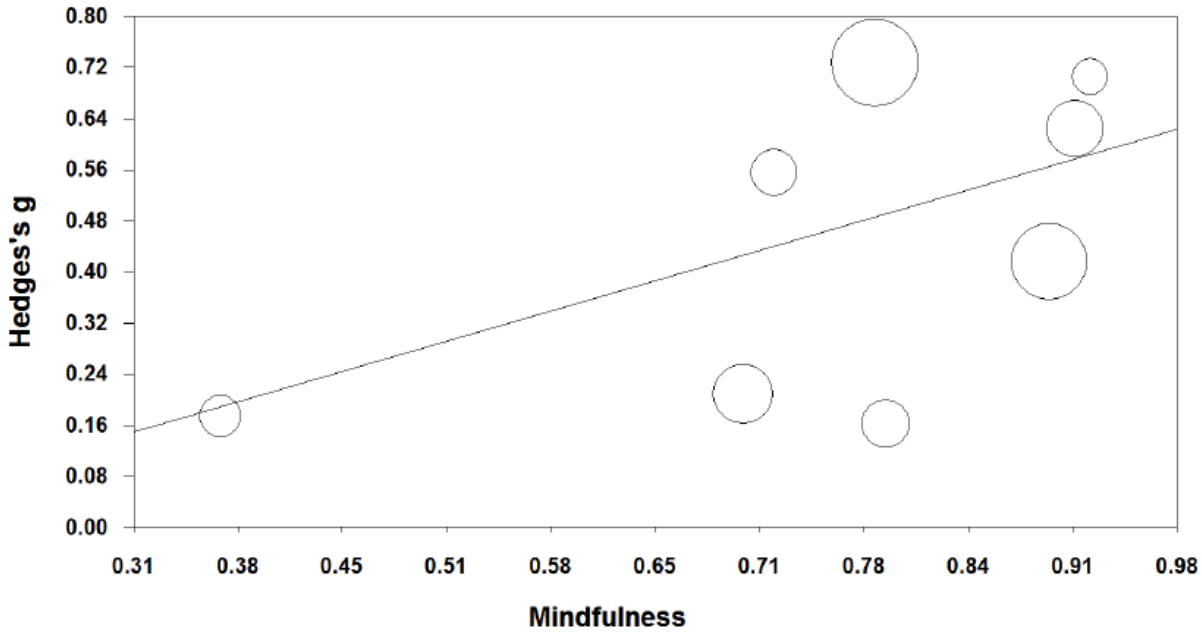

Fig. 3

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Monttreal, November 17, 2016

Conflict of Interest Statement

All authors of this article had access to all study data, are responsible for all contents of the article, and had authority over manuscript preparation and the decision to submit the manuscript for publication. Authors of this article have approved the submission of the manuscript to the journal and have no competing interests. The data presented in the article is novel and has not yet been presented elsewhere.

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Highlights

- We conducted a meta-analysis to provide a review of traditional meditation retreats.
- The meta-analysis included 21 studies enrolling 2,912 participants.
- Psychological outcomes and mindfulness levels were measured in healthy populations.
- We obtained Hedge's *g* =.49 in between group analyses, .45 in pre-post analyses.
- The results obtained are robust and are maintained at follow-up.
- Study quality and significant heterogeneity limit confidence in effect estimates.
- Mindfulness levels strongly moderated clinical outcomes.

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