



Mindfulness Meditation Training Reduces Aggression and Improves Well-Being in Highly Stressed Law Enforcement Officers

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Abstract

Law enforcement officers are at risk of decreased mental and physical health due to the high demands and stressful nature of police work. Self-regulatory cognitive training may be particularly efficacious for law enforcement officers. The present study examined the feasibility and efficacy of three standardized, 8-week mindfulness-based interventions: Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Resilience Training (MBRT), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK) to foster psychological well-being for law enforcement officers. We expected no between group differences in outcomes. Further, we hypothesized that increases in dispositional mindfulness would mediate reductions in aggression and improvements in well-being. Eighty-four law enforcement officers were recruited. All procedures were performed online. Participants completed measures of aggression, stress, depression, emotion dysregulation, anxiety, and mindfulness. Seventy-nine officers were then randomized into one of three interventions: MBSR, MBRT, or mPEAK. Participants completed study assessments, again, after 4 and 8 weeks of mindfulness training. Fifty officers (median age = 44; 34 male) completed their assigned training. At baseline, 92% of police officers reported moderate to high levels of stress. The mPEAK program exhibited a 24% attrition rate, while MBSR and MBRT showed attrition rates of 44% and 41% respectively. There were no significant outcome differences between groups. Participants reported significant decreases in aggression and stress after training. Depression, difficulties in emotion regulation, and anxiety scores also decreased significantly. Importantly, increases in dispositional mindfulness mediated the relationship between aggression and stress and depression. These data indicate that mindfulness training may produce improvements in well-being in a sample of highly stressed police officers.

Keywords Mindfulness · Law Enforcement · Aggression · Stress · Depression

Introduction

Law enforcement is one of the most stressful occupations in the USA because of a spectrum of the health-debilitating conditions that correspond to the constant threat of violence associated with being a police officer (Anshel 2000; Goodman 1990). Exposure to frequent stressors increases the development of clinical depression and negative health

in this population (Can and Hendy 2014; Wang et al. 2010). Based on the Angry-Aggression Theory, recurrent experiences of threat are a primary driver of the use of excessive force and violence in law enforcement (Griffin and Bernard 2003). These stressful experiences have also led to ineffective coping strategies that exacerbate maladaptive behaviors in law enforcement.

Accordingly, law enforcement officers are in critical need of well-being enhancement due to their high-risk and high-stress work environment. Converging lines of evidence indicate that law enforcement officers have historically refrained from seeking psychological therapy due to police-culture stigmas, time and financial constraints, and the heightened inability to recognize maladaptive behaviors (Bell and Eski 2016; Karaffa and Koch 2016). To this end, mindfulness meditation, a technique practiced by enhancing nonreactive awareness of self-referential

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sensory and cognitive events, may be particularly efficacious for this unique population. That is, mindfulness may be attractive to law enforcement officers because it is developed through self-regulatory, disciplined, and effortful techniques. Recent studies have successfully employed standardized mindfulness-based interventions to target law enforcement officer health (Bergman et al. 2016; Christopher et al. 2016; Ribeiro et al. 2020). However, there have been no randomized clinical trials that have examined the effects of various empirically supported mindfulness-based interventions on law enforcement well-being.

In the late 1970s, Mindfulness-Based Stress Reduction (MBSR) was developed as a standardized and scalable mindfulness intervention (Kabat-Zinn 1982). MBSR significantly improves a wide spectrum of health outcomes (Biegel et al. 2009; Hazlett-Stevens 2012; Serpa et al. 2014). However, no known studies have examined the effects of MBSR on American law enforcement officers. Similarly, Mindfulness-Based Resilience Training (MBRT) was developed by police officers as a derivative of MBSR tailored to directly target law enforcement well-being (Christopher et al. 2016). MBRT decreases aggression (Ribeiro et al. 2020) and increases dispositional, or stable trait, mindfulness in law enforcement officers (Bergman et al. 2016). Another MBSR-based derivative and efficacious 8-week mindfulness intervention, Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK), was designed to promote mental and physical well-being in elite athletes and first responders (Haase et al. 2015). To date, there are no known trials that have examined and compared the effects of MBSR, MBRT, and mPEAK.

The primary aim of this study was to compare the feasibility and efficacy of three, separate 8-week mindfulness-based interventions, MBSR, MBRT, and mPEAK, in reducing aggression and stress in law enforcement officers. We assessed feasibility through intervention completion and attrition rates. Intervention efficacy was assessed by examining the primary outcomes: self-reported levels of aggression and stress before, after 4 weeks, and after 8 weeks of interventions. Secondary outcomes assessed whether self-reported levels of depression, emotion dysregulation, and anxiety were reduced across time. We hypothesized that the measured outcomes will significantly improve across time across all interventions. Due to the significant overlap in content and delivery, we did not expect any significant between group differences on any of the outcomes. Exploratory analyses aimed to identify if increases in hypothesized improvements in dispositional mindfulness mediated the reductions in aggression and improvements in psychological well-being (i.e., stress, depression, and anxiety).

Methods

Participants

Participants were recruited by distributing flyers across California-based police stations and mailing lists. Participant inclusion criteria included currently employed California-based law enforcement officers with at least 1 year of service and no prior meditation experience. Participants were offered 26 credit hours for study completion that counted towards the minimum 664 h required to obtain a Peace Officer Standards and Training (POST) certification. POST is a professional certification program that sets standards for law enforcement officers in California. All law enforcement officers in POST participating agencies are required to acquire a POST certification to maintain their status as a law enforcement officer. Eighty-four law enforcement officers were recruited from 54 California-based police departments. Thirty-four signed consent but withdrew from the study for several reasons (Fig. 1). Fifty participants, recruited from 33 California-based police departments (mostly White; median age = 44 years old; 34 males; Table 1), were included in the final analysis.

Sample Size Determination

Our primary aim was to examine if mindfulness-based interventions would produce significant reductions in aggression, stress, depression, emotion dysregulation, and anxiety. Statistical power calculations revealed that a total of 48 participants would provide 80% power (G^* power, 3.1), to detect a significant and large effect size corresponding to improvements in aggression (primary outcome) (large effect size = $\eta^2_p = 0.20$) across all groups (main effect of time).

Measures

A battery of psychometrically validated questionnaires determined if mindfulness-based interventions were associated with well-being improvement in police officers. All assessments were collected and scored using Research Electronic Data Capture (REDCap) (Harris et al. 2009) with laboratory-provided iPads (Apple Inc). Assessments were delivered before interventions (pre-intervention), after 4 weeks (mid-intervention), and after 8 weeks of training (post-intervention).

Aggression Questionnaire (AGQ)

To address the primary aim of the present study, Buss and Perry's (1992) Aggression Questionnaire (AGQ) was used to measure four subcomponents of aggression in police officers including physical aggression, verbal aggression, anger, and

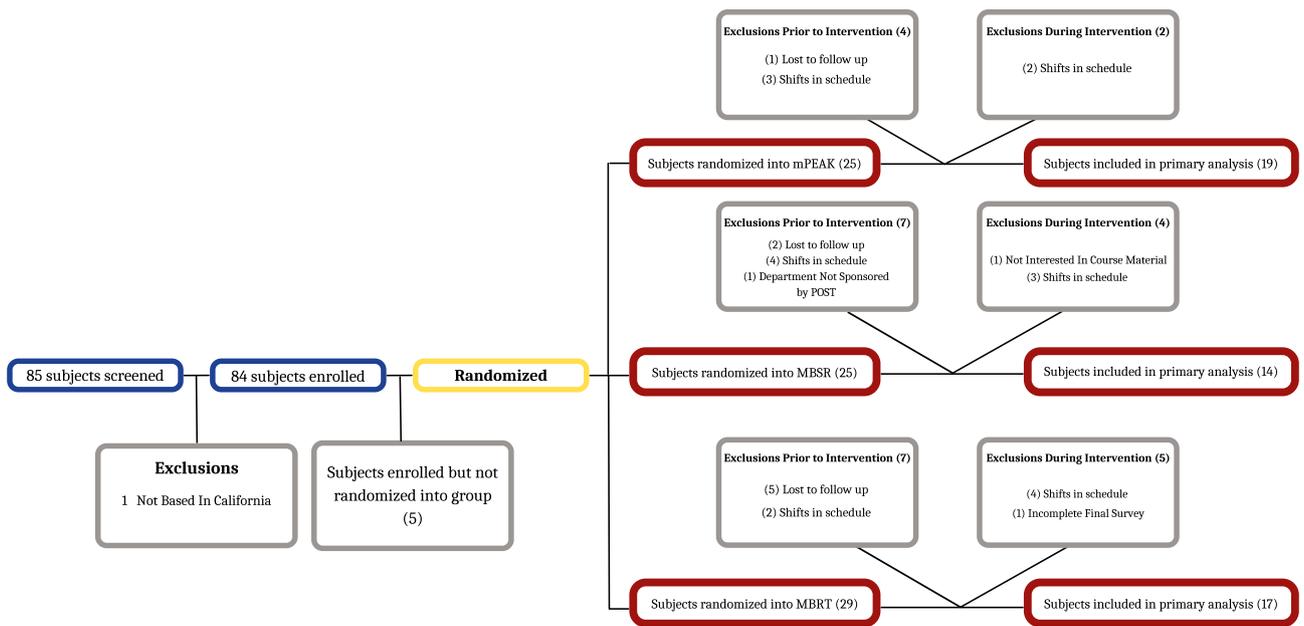


Fig. 1 CONSORT flowchart of participants

Table 1 Participant demographics

| Gender | <i>N</i> | % |
|---|----------|-------|
| Male | 34 | 68.0% |
| Female | 16 | 32.0% |
| Ethnicity | <i>N</i> | % |
| White | 35 | 70.0% |
| Other | 9 | 18.0% |
| Black or African American | 3 | 6.0% |
| Asian | 1 | 2.0% |
| Alaskan Indian or Alaskan Native | 1 | 2.0% |
| Native Hawaiian or Other Pacific Islander | 1 | 2.0% |
| Relationship status | <i>N</i> | % |
| Married | 31 | 62.0% |
| Single | 8 | 16.0% |
| Partnered | 6 | 12.0% |
| Divorced | 5 | 10.0% |
| Highest level of education | <i>N</i> | % |
| High school | 1 | 2.0% |
| Some college, no degree | 9 | 18.0% |
| Occupational/technical/vocational program | 1 | 2.0% |
| Associate degree | 6 | 12.0% |
| Bachelor's degree | 17 | 34.0% |
| Master's degree | 15 | 30.0% |
| Doctoral degree | 1 | 2.0% |

Self-reported demographics of study population (N=50). During data collection, all participants resided in California

hostility. The AGQ is a well-validated scale that employs a 5-point Likert scale ranging from 1 (extremely uncharacteristic of me) to 5 (extremely characteristic of me). Higher scores indicated higher levels of self-reported aggression. The internal consistency of this scale in the present sample ranged from good to excellent (Cronbach 1951) (pre-intervention: Cronbach's $\alpha=0.82$; mid-intervention: $\alpha=0.89$; post-intervention: $\alpha=0.88$).

Perceived Stress Scale (PSS)

Stress is a highly prevalent condition in police officers (Anshel 2000). The Perceived Stress Scale (PSS) was used to determine whether mindfulness-based interventions are associated with meaningful reductions in stress in the present population (Cohen et al. 1983). The PSS is the most widely used scale to measure the perception of stress (Khalili et al. 2017). Higher scores indicated higher levels of perceived stress. For comprehensiveness, the 14-item version of the PSS was used, consisting of a 5-point Likert scale ranging from 0 (never) to 4 (often). The reliability of the PSS in this population ranged from good to excellent (pre: $\alpha=0.85$; mid: $\alpha=0.88$; post: $\alpha=0.87$).

Beck Depression Inventory-II (BDI-II)

To investigate conditions that have a high comorbidity rate with stress and aggression, symptoms of depression were also measured. The Beck Depression Inventory-II (BDI-II) (Beck et al. 1996), a well-validated and widely used scale, measured depressive symptomology, mood disturbance, negative affect, and dysphoria. Higher scores indicated greater levels of depressive symptomology/mood. The BDI-II demonstrated excellent reliability in the present sample (pre: $\alpha=0.91$; mid: $\alpha=0.92$; post: $\alpha=0.91$).

Difficulties in Emotion Regulation Scale (DERS)

The Difficulties in Emotion Regulation Scale (DERS) was also administered to assess whether mindfulness-based interventions can improve emotion dysregulation in police officers (Gratz and Roemer 2004). This 36-item scale consists of 6 subscales: nonacceptance of emotional responses, difficulty engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. Subscales are not presented here. Higher DERS scores indicated greater difficulties in emotion regulation. Reliability of this scale was excellent (pre: $\alpha=0.94$; mid: $\alpha=0.95$; post: $\alpha=0.95$).

State Anxiety Inventory (SAI)

Anxiety is a widely experienced condition by police officers due to the high-risk nature of law enforcement. Thus, state anxiety was measured using the well-validated State Anxiety Inventory (SAI) to determine if police officers would report reduced anxiety after mindfulness-based interventions (Spielberger 1983). All items on the SAI are rated on a 4-point Likert scale ranging from 1 (almost never) to 4 (almost always). The internal consistency of this scale was excellent (pre: $\alpha=0.94$; mid: $\alpha=0.93$; post: $\alpha=0.94$).

Five Facet Mindfulness Questionnaire (FFMQ)

For exploratory analyses, dispositional mindfulness was measured using the Five Facet Mindfulness Questionnaire (FFMQ) to determine whether changes in mindfulness mediate the relationship between aggression and other measured outcomes (Baer et al. 2006). The 39-item FFMQ consists of five subscales: observation, description, awareness of actions, non-judgment, and non-reactivity (not presented here). Higher scores represented higher trait mindfulness. The reliability of this scale was excellent (pre: $\alpha=0.92$; mid: $\alpha=0.93$; post: $\alpha=0.95$).

Procedure

After signing informed consent, participants were mailed a Laboratory-issued iPad and were instructed to employ them during their respective meditation interventions. The use of the same meditation-delivery device sought to reduce interindividual variability in technological interruptions (i.e., telephone calls; email notifications) and potential deviations in audio clarity.

Pre-Intervention Assessment

Participants then completed a spectrum of validated well-being assessments (see Measures).

Randomization

After completing these surveys, participants were randomized to one of three, 8-week mindfulness-based interventions (MBSR, MBRT, mPEAK) and were stratified by sex using an Excel-based random number generator.

Interventions

Participants attended eight 2.5-h weekly classes held via the videoconferencing platform, Zoom (Zoom Video Communications Inc., 2019). The courses were taught by certified

mindfulness teachers who closely followed standardized course guidelines. All interventions included mindfulness practices, experiential exercises, didactic presentations, group discussions, and home practices.

Mindfulness-Based Stress Reduction (MBSR)

MBSR provided participants with formalized mindfulness instruction incorporating mindfulness-based coping strategies and direct attenuation of affective appraisals of arising sensory, cognitive, and affective events. The objective of MBSR was to allow participants to cultivate an awareness of one's responses to stress and foster effective coping strategies to modify these responses.

MBSR consisted of 2.5-h classes once a week and a 1-day-long (7-h) session completed after 5 weeks of training. Mindfulness was taught through a didactic, experiential, and inductive framework (Kabat-Zinn 1982; Van Dam et al. 2018). Throughout the course, participants were taught to attend to the present moment, engaging somatic (body, breathing) sensations non-reactively. In addition to the spectrum of guided mindfulness-based practices (e.g., sitting meditation, body scan, and Hatha Yoga) introduced in the first 4 weeks of the course, the last 4 weeks also included real-life applications of mindfulness such as emotion regulation and compassion for others.

Mindfulness-Based Resilience Training (MBRT)

MBRT is a derivative of MBSR that was designed to enhance resilience in law enforcement officers by integrating standardized mindfulness practices with Cognitive Behavioral Therapy and psychoeducation (Christopher et al. 2018). This program focused on occupational stress and trauma, emphasizing reactivity to stressors inherent in police work such as critical incidents, public scrutiny, and interpersonal challenges.

MBRT consisted of eight 2.5-h weekly classes and a 1-day-long (7 h) session completed after the first week of training. The program contained mindfulness practices and didactic exercises that were specifically tailored to a law enforcement population. The first 4 weeks of training focused on learning the practice of mindful awareness of the breath and body using exercises that paralleled MBSR, including body scan, sitting and walking meditation, and group discussion. As the course progressed, lessons incorporated real-life applications of mindfulness such as learning strategies to cope in the face of acute and chronic stressors common to police work and fostering compassion for the self and others.

Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK)

The mPEAK program was derived from MBSR and combined mindfulness meditation, sports psychology, positive psychology, neuroscience instruction, and group performance coaching to provide training that supported participants improving performance in settings ranging from the workplace to athletics and emergency response situations (Haase et al. 2015). The program aimed to develop dispositional mindfulness, the innate capacity for nonreactive sustained attention to the present moment (Zeidan et al. 2018), through empirically supported didactics and practices that were tailored towards the goals of the individual.

mPEAK consisted of eight 2.5-h weekly classes and 1-day-long (7 h) practice completed after 5 weeks of training. The first 4 weeks of the course introduce mindful awareness of the body and mind, while the last 4 weeks of the course focus on incorporating newly acquired mindfulness skills to improve resilience, performance, and self-compassion.

Mid- and Post-Intervention Assessments

Participants completed surveys (see Measures) again after 4 (mid-intervention) and 8 (post-intervention) weeks of training, respectively.

Data Analyses

Do Meditation-Related Health Benefits Vary by Training Dosage and/or by Group?

Five, separate 3 (pre- vs mid- vs post-intervention) \times 3 (MBSR vs MBRT vs mPEAK) Repeated Measures (RM) analysis of variance (ANOVA) examined if there were significant differences in (1) aggression (AGQ), (2) stress (PSS), (3) depression (BDI-II), (4) difficulties in emotion regulation (DERS), and (5) anxiety (SAI) across the interventions and/or by group. For each of the ANOVAs, significant main effects and interactions were examined with planned simple effects tests.

Do Increases in Dispositional Mindfulness Mediate Hypothesized Improvements in Aggression and Well-Being?

Three separate mediation models (PROCESS macro in SPSS version 26.0) (Hayes 2013) examined if improvements (pre- to post-intervention across all participants) in dispositional mindfulness (total FFMQ) mediated the hypothesized relationship between change (pre- to post-intervention) in aggression and in health outcomes, including (1) stress, (2) depression, and (3) anxiety, respectively.

Results

The large majority (92%) of law enforcement officers reported moderate to high perceived stress at baseline. Thirty percent (30%) of officers met the criterion for moderate or severe clinical depression (Beck et al. 1996). Within this 30% of officers who reported levels of depression, 87% scored in the clinical range on the Difficulties in Emotion Regulation Scale (Harrison et al. 2010; Staples and Mohlman 2012), indicating a large amount of overlap. Further, 48% of officers crossed the threshold for probable clinical levels of anxiety (Julian 2011). Within this cohort of stressed and anxious participants, 58% reported moderate to severe depression, and 63% exhibited difficulty regulating emotions.

Attrition Rates of Mindfulness-Based Interventions

Twenty-nine participants were randomly assigned to MBRT. Twenty-five participants were randomized to MBSR and mPEAK, respectively (Fig. 1). The mPEAK program saw 24% attrition, while MBSR (44%) and MBRT (41%) exhibited higher attrition rates. The most common cause for drop-out during interventions was conflicting intervention and work schedules (see Fig. 1). Nineteen subjects completed mPEAK, 14 completed MBSR, and 17 completed MBRT.

Mindfulness Training Was Associated with Lower Aggression

Across all participants, mindfulness training was associated with lower self-reported aggression, $F(2, 90) = 7.88$,

$p < 0.001$, $\eta_p^2 = 0.15$ (Fig. 2). The main effect of time was driven by the significant reduction in aggression from baseline to 8 weeks of training ($p = 0.004$). There was no significant change in aggression from baseline to 4 weeks of training ($p = 0.10$) or 4 to 8 weeks of training ($p = 0.10$). There was no group main effect, $F(2, 45) = 0.56$, $p = 0.57$, $\eta_p^2 = 0.02$, or a group \times time interaction, $F(4, 90) = 1.82$, $p = 0.13$; $\eta_p^2 = 0.08$.

Mindfulness Training Was Associated with Reduced Stress

Out of the 92% of participants who reported moderate to high levels of perceived stress at baseline, 80% reported a reduction in perceived stress after meditation training and 26% no longer met the standardized cutoff for moderate to high levels of perceived stress. The significant main effect of time on perceived stress, $F(2, 90) = 10.01$, $p < 0.001$, $\eta_p^2 = 0.18$ (Fig. 3), was driven by the reduction from baseline to 4 weeks ($p < 0.05$) and from baseline to 8 weeks of training ($p < 0.001$). PSS scores also were reduced from 4 to 8 weeks of training, but this effect was not significant ($p = 0.09$). There were no between group differences, $F(2, 45) = 1.89$, $p = 0.16$, $\eta_p^2 = 0.08$, or a group \times time interaction, $F(4, 90) = 0.63$, $p = 0.64$, $\eta_p^2 = 0.03$.

Mindfulness Training Was Associated with Decreased Depression

Law enforcement officers reported a significant reduction in depression, $F(2, 90) = 35.00$, $p < 0.001$; $\eta_p^2 = 0.44$ (Fig. 4), that was associated with decreases across all time points (baseline to 4 weeks: $p < 0.001$, baseline to 8 weeks:

Fig. 2 Improvements in aggression from pre- (baseline), mid- (after 4 weeks), to post- (after 8 weeks) interventions (i.e., Mindfulness-Based Resilience Training (MBRT; $n = 17$), Mindfulness-Based Stress Reduction (MBSR; $n = 14$), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK; $n = 19$)). The combined group represents all participants across interventions ($n = 50$). Error bars represent ± 1 standard error. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

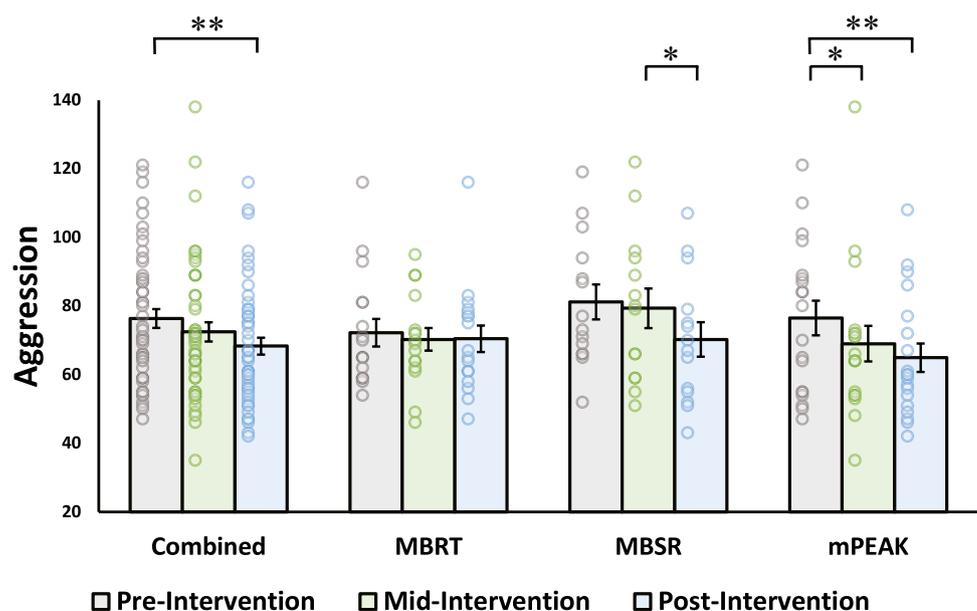
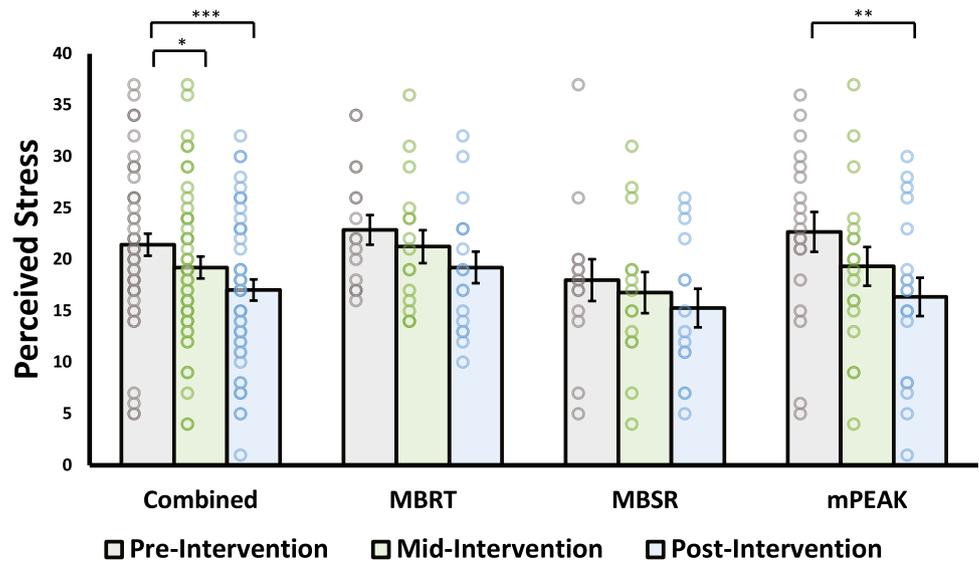


Fig. 3 Improvements in perceived stress from pre- (baseline), mid- (after 4 weeks), to post- (after 8 weeks) interventions (i.e., Mindfulness-Based Resilience Training (MBRT; $n=17$), Mindfulness-Based Stress Reduction (MBSR; $n=14$), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK; $n=19$)). The combined group represents all participants across interventions ($n=50$). Error bars represent ± 1 standard error. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$



$p < 0.001$, 4 to 8 weeks: $p < 0.01$). There was no group main effect, $F(2, 45) = 1.64$, $p = 0.21$, $\eta_p^2 = 0.07$, or significant group differences across time, $F(4, 90) = 0.20$, $p = 0.94$; $\eta_p^2 = 0.01$.

Improvements in emotion regulation from 4 to 8 weeks of training exhibited a trend towards significance ($p = 0.06$). There were no group, $F(2, 45) = 1.04$, $p = 0.36$, $\eta_p^2 = 0.04$, or group \times time interactions, $F(4, 90) = 0.53$, $p = 0.72$; $\eta_p^2 = 0.02$.

Mindfulness Training Was Associated with Improvements in Emotion Regulation

Reports of difficulties in emotion regulation were also reduced after participating in mindfulness-based training, $F(2, 90) = 14.02$, $p < 0.001$; $\eta_p^2 = 0.24$ (Fig. 5). This main effect of time was driven by improvements from baseline to 4 weeks ($p = 0.002$) and 8 weeks of training ($p < 0.001$).

Mindfulness Training Was Associated with Reductions in State Anxiety

The significant change in state anxiety across time, $F(2, 88) = 13.75$, $p < 0.001$, $\eta_p^2 = 0.24$ (Fig. 6), was driven by the reductions from baseline to each measured time point (baseline to 4 weeks: $p = 0.03$, baseline to 8 weeks: $p < 0.001$) and reductions from mid- to post-intervention (4 weeks to

Fig. 4 Improvements in depression from pre- (baseline), mid- (after 4 weeks), to post- (after 8 weeks) interventions (i.e., Mindfulness-Based Resilience Training (MBRT; $n=17$), Mindfulness-Based Stress Reduction (MBSR; $n=14$), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK; $n=19$)). The combined group represents all participants across interventions ($n=50$). Error bars represent ± 1 standard error. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

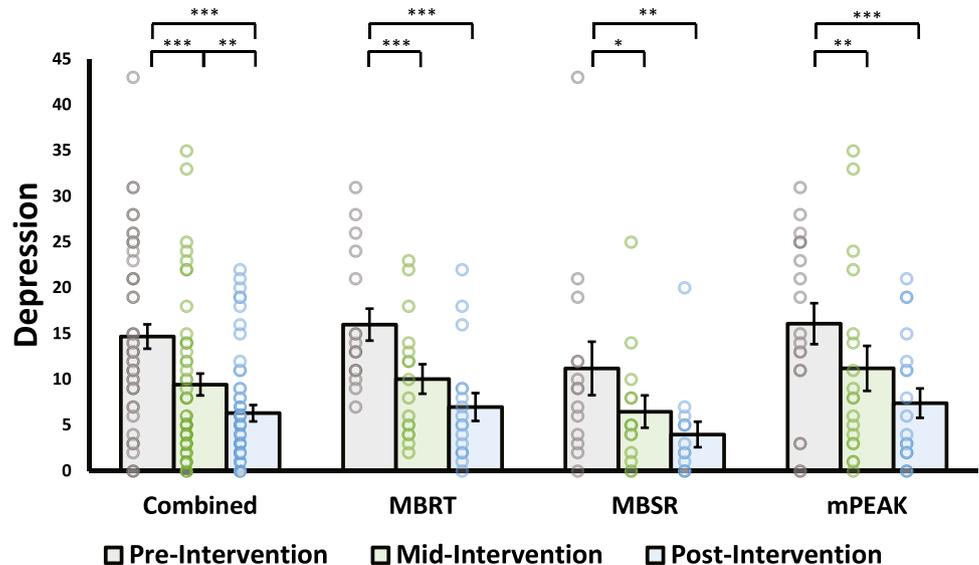
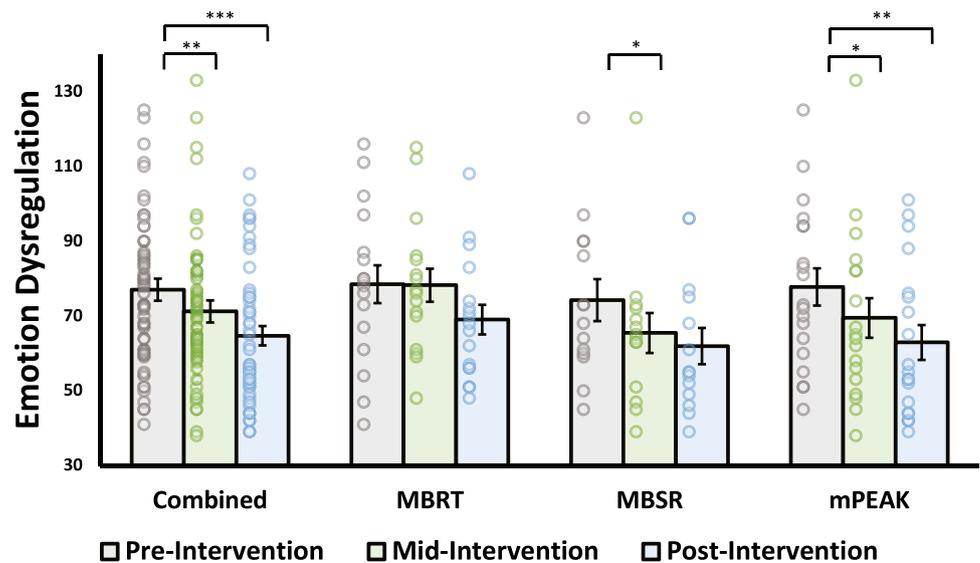


Fig. 5 Improvements in difficulties in emotion regulation from pre- (baseline), mid- (after 4 weeks), to post- (after 8 weeks) interventions (i.e., Mindfulness-Based Resilience Training (MBRT; $n = 17$), Mindfulness-Based Stress Reduction (MBSR; $n = 14$), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK; $n = 19$)). The combined group represents all participants across interventions ($n = 50$). Error bars represent ± 1 standard error. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$



8 weeks: $p = 0.01$). There were no significant differences between groups, $F(2, 44) = 2.34$, $p = 0.11$, $\eta_p^2 = 0.10$, or group differences across time, $F(4, 88) = 0.37$, $p = 0.83$; $\eta_p^2 = 0.02$.

Higher Dispositional Mindfulness Mediated the Relationship Between Aggression and Stress

A mediation analysis tested whether dispositional mindfulness mediated the potential relationship between the change in aggression and stress in law enforcement officers. The first step of the mediation model revealed that reductions in perceived stress predicted reductions in aggression, $b = 0.87$, $t(48) = 2.81$, $p = 0.007$. Step 2 showed that lower stress significantly predicted higher dispositional mindfulness, $b = -1.46$, $t(48) = -5.32$, $p < 0.001$. In step 3 of the model, increases in mindfulness were associated with decreases in

aggression after controlling for changes in perceived stress, $b = -0.53$, $t(48) = -3.63$, $p < 0.001$. Step 4 revealed that after controlling for increases in mindfulness, changes in perceived stress no longer predicted aggression, $b = 0.10$, $t(48) = 0.29$, $p = 0.77$. Thus, the significant relationship between perceived stress and aggression was fully mediated by higher dispositional mindfulness, $ab = 0.77$, 95% Ba CI [0.17, 1.55] (Fig. 7).

Dispositional Mindfulness Partially Mediated the Relationship Between Aggression and Depression

A separate mediation analysis tested the hypothesis that improvements in dispositional mindfulness will mediate the relationship between improvements in aggression and

Fig. 6 Improvements in state anxiety from pre- (baseline), mid- (after 4 weeks), to post- (after 8 weeks) interventions (i.e., Mindfulness-Based Resilience Training (MBRT; $n = 17$), Mindfulness-Based Stress Reduction (MBSR; $n = 14$), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK; $n = 19$)). The combined group represents all participants across interventions ($n = 50$). Error bars represent ± 1 standard error. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

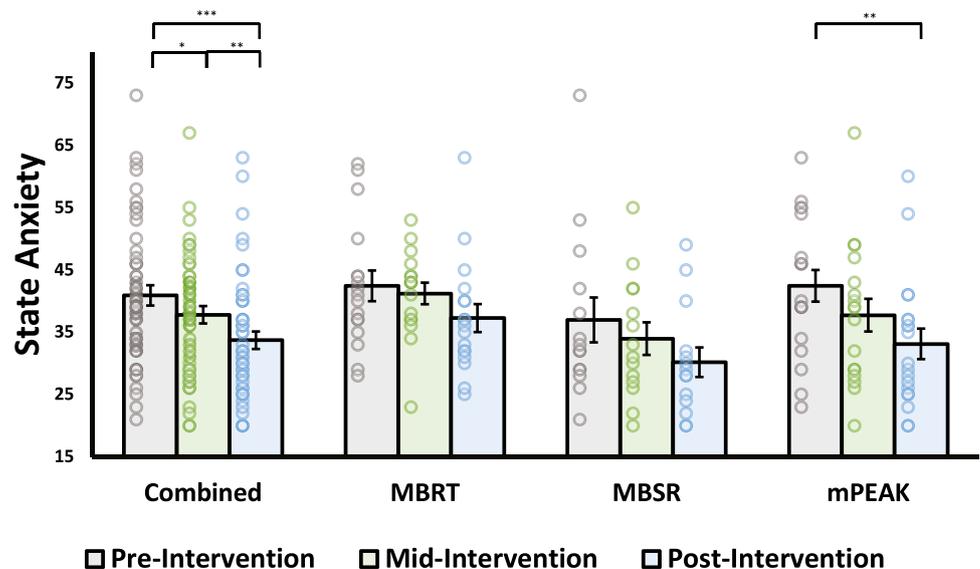
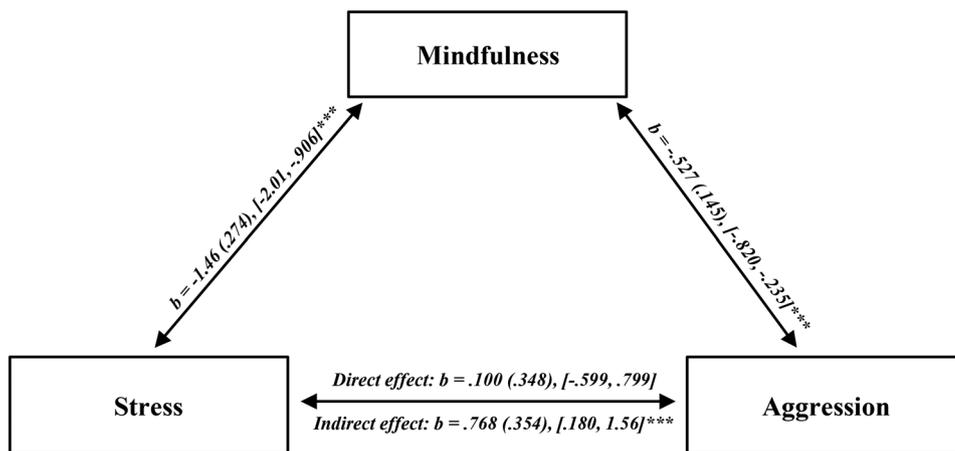


Fig. 7 Improvements in mindfulness (pre- to post-intervention) fully mediated the relationship between reductions in stress (pre- to post-intervention) and reductions in aggression (pre- to post-intervention) ($ab=0.768$, 95% Ba CI [0.176, 1.55]) * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$



depression. Reductions in depression predicted reductions in aggression, $b = 1.20$, $t(48) = 4.27$, $p < 0.001$. Decreases in depression also significantly predicted increases in mindfulness, $b = -1.16$, $t(48) = -3.90$, $p < 0.001$. When controlling for changes in depression, improvements in mindfulness were associated with reductions in aggression, $b = -0.40$, $t(48) = -3.22$, $p = 0.002$. Depression still predicted aggression after controlling for changes in mindfulness, although the relationship was significantly weakened, $b = 0.73$, $t(48) = 2.49$, $p = 0.02$. Therefore, improvements in mindfulness partially mediated the relationship between depression and aggression, $ab = 0.46$, 95% Ba CI [0.08, 0.86] (Fig. 8).

There Was No Relationship Between Aggression and State Anxiety

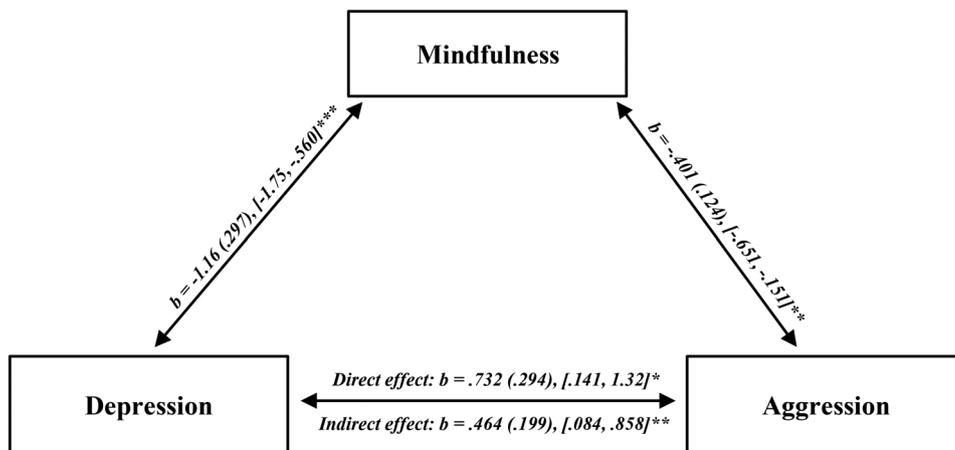
The same mediation model tested the effect of dispositional mindfulness on the relationship between aggression and state anxiety. The first step of the mediation analysis revealed that improvements in state anxiety did not predict reductions in aggression, $b = 0.27$, $t(48) = 1.23$, $p = 0.23$.

Discussion

The present study investigated the feasibility and efficacy of Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Resilience Training (MBRT), and Mindful Performance Enhancement, Awareness, and Knowledge (mPEAK) to reduce aggression and improve well-being in a cohort of law enforcement officers. As predicted, mindfulness-based interventions were associated with significant reductions in aggression, emotion dysregulation, depression, stress, and anxiety after just 8 weeks of mental training. The present findings also support our hypothesis that there would be no significant between-group differences on any of the measured outcomes. Interestingly, exploratory analyses revealed that increases in dispositional mindfulness mediated reductions in aggression and improvements in psychological well-being (i.e., reduced perceived stress and depression).

At baseline, the vast majority (92%) of participants reported moderate to high levels of perceived stress. This finding aligns with past research indicating that law enforcement is one of the most stressful occupations (Anshel 2000;

Fig. 8 Improvements in mindfulness (pre- to post-intervention) partially mediated the relationship between reductions in depression and reductions in aggression ($ab=0.464$, 95% Ba CI [0.072, 0.856]) * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$



Goodman 1990). Importantly, out of the 92% of stressed law enforcement officers, 80% reported a reduction in perceived stress after 8 weeks of meditation training, and 26% were no longer moderately or highly stressed.

Across all interventions, mindfulness-based training was associated with improvements in all measured outcomes (i.e., reductions in aggression, stress, depression, difficulties in emotion regulation, and anxiety). As predicted, there were no significant differences in outcomes between MBSR, MBRT, and mPEAK. However, mPEAK demonstrated a lower attrition rate (24%) than MBSR (44%) and MBRT (41%). The mPEAK program is specifically designed and taught as a performance enhancement intervention. This focus may be particularly appealing to communities, such as law enforcement, that view therapeutic interventions with skepticism and struggle to recognize their own maladaptive behaviors (Bell and Eski 2016). Nonetheless, these results add to previous findings suggesting that various mindfulness-based interventions can improve the psychological well-being of law enforcement officers (Bergman et al. 2016; Christopher et al. 2018; Trombka et al. 2021).

The present study also demonstrated that depressive mood and stress contribute to levels of aggression in law enforcement officers. Importantly, improvements in dispositional mindfulness following meditation training mediated the relationship between aggression and stress; this same improvement in dispositional mindfulness also partially mediated the relationship between aggression and depression. These findings suggest that higher levels of mindfulness developed through mindfulness training may reduce aggression by way of reductions in depressive mood and perceived stress.

One possible explanation for this effect is the ability of mindfulness meditation to reduce rumination, a common symptom underlying depression, stress, and aggression (Deyo et al. 2009; Hill and Updegraff 2012; Joormann and Gotlib 2010; Miklósi et al. 2014; Ottaviani et al. 2011; Pedersen et al. 2011; Raes and Williams 2010; Rusting and Nolen-Hoeksema 1998). Individuals exposed to chronic stress, such as police officers, are more likely to develop ruminative tendencies that exacerbate prolonged physiological responses to acute stressors (Gerin et al. 2012). Mindfulness meditation reduces negative, repetitive thought processes by enhancing the ability to stabilize attention in the present moment, recognize discursive mental events, and detach from affective appraisals (Zeidan et al. 2014). This disposition may serve as a protective factor against the frequent stressors police officers face.

However, there are several limitations of this study that should be considered. First, this study solely relies on self-reported data. Thus, research measuring the direct consequences of meditation training in the field is needed to

confirm these claims. Further, the questionnaires that were administered have not been validated on law enforcement officers prior to the present study. Another major limitation of this study is the lack of a control group. Without a non-mindfulness-based control group, it is difficult to rule out the possibility that the measured psychological improvements were caused by social support, demand characteristics, facilitator attention, and other non-specific effects. Further, the generalizability of the present study is limited because all law enforcement officers were California-based.

Future trials examining the relationship between mindfulness training and police officer aggression and well-being should include physiological markers that reflect psychological changes, field-based measures of aggression, an adequate control group, and a sample that is more representative of the population. Additionally, based on these findings, future trials should seek to enroll a larger cohort of officers in order to tease apart any differences between the three interventions masked by the small sample size. While all interventions demonstrated promising efficacy, the notable difference in attrition between the three interventions bears further investigation.

In summary, mindfulness training may be uniquely efficacious for law enforcement officers because of its self-disciplinary nature and its ameliorating effects on stress responsivity. Consistent with previous findings (Zeidan et al. 2010a, b), the benefits of mindfulness training were observed in the first 4 weeks of training, suggesting that mindfulness training could be a suitable fast-acting, nonpharmaceutical approach to improving negative psychological consequences that arise from a career in law enforcement. According to the present findings, these improvements in psychological health may lead to reductions in aggression. Thus, mindfulness training may not only improve police officer health but may also benefit the public by attenuating excessive use of force by law enforcement officers. To this extent, the present findings support the use of mindfulness-based interventions to reduce aggression and foster well-being in law enforcement officers.

Author Contribution LK, JGR, DM, VO, GR, and JGD: designed the study, collected data, and wrote the manuscript, NMH: helped schedule participants, FZ: designed and supervised the study, analyzed the data, wrote and edited the manuscript.

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Data Availability All data corresponding to this study and SPSS syntax code will be made available on our laboratory's website (<http://www.zeidanlab.com>).

Declarations

Ethics Approval The study was approved by the University of California San Diego Institutional Review Board (IRB#192007).

Consent to Participate Informed consent was obtained from all participants included in the study.

Conflict of Interest The authors declare no competing interests.

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