



The Effectiveness of Mindfulness-Based Interventions for Police Officers' Stress Reduction: a Systematic Review

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Accepted: 29 December 2022 / Published online: 30 January 2023
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Abstract

The profession of a police officer is associated with high levels of stress, which can have harmful consequences for officers' personal lives, the police organisation, and society. This systematic review aims to synthesise recent literature on the effectiveness of mindfulness-based intervention related to stress reduction (MBIs) in a sample of police officers. The search of relevant articles was applied in four databases (SpringerLink, Web of Science, Academic Search Ultimate (EBSCO), and PubMed), using the following inclusion criteria: (1) study involved police officers; (2) study used (quasi)experimental research design; (3) mindfulness-based stress reduction intervention was applied as the main intervention; and (4) study presented pre- and post-intervention measures and quantitative results of stress. The systematic review of eight articles included in the analysis revealed that MBIs were effective in reducing police officers' stress and other stress-related outcomes (sleep problems, post-traumatic stress disorder (PTSD), negative affect, burnout).

Keywords Stress reduction · Mindfulness-based interventions · Police officers · Systematic review

Introduction

On a daily work basis, police officers face a variety of different stressors, which generally fall into two categories: job-related stressors (working in courts, facing traumatic events, shift work, long working hours and working overtime) and stressors related to the context of the work, also known as organisational stressors, which are related to the characteristics of the organisation (the behaviour of colleagues, working relationships, bureaucracy and inadequate facilities at work) (Violanti et al. 2017). These stressors place a police officer's job at a higher risk of stress-related outcomes, e.g. post-traumatic stress disorder (Patterson et al. 2014). Additionally, numerous studies have revealed that police officers face both physical and psychological health problems, which may affect police officers' work quality (e.g. decision-making or the ability to react quickly to dangerous situations), personal relationships and quality of life (Acquadro et al. 2020; Demou et al. 2020; Violanti et al. 2017).

The first interventions for stress reduction among police officers date back almost 40 years; however, to this day, not much is known about effective ways to help police officers deal with stress at work. For example, a meta-analysis shows that traditional stress reduction techniques (e.g. psychoeducation, physical education, relaxation training, cognitive restructuring, imaginary guidance, writing assignments, etc.) have a small effect on police officers' stress reduction (Patterson et al. 2014). Clearly, finding other ways to reduce the stress experienced by police officers effectively is becoming important. In the last decade, mindfulness-based intervention related to stress reduction (or mindfulness-based intervention or as MBIs in future references) have become one of the most popular applied methods that can help people to reduce stress. However, little is known about the applicability of mindfulness practices to police officers' work. Therefore, this systematic review aims to synthesise recent literature on the effectiveness of MBIs for stress reduction in a sample of police officers.

Stress in Police Officers

The profession of a police officer is inevitably linked to stressors that affect the physical and mental health, and the psychosocial well-being of officers. Police officers face both chronic and acute stressors at work. The observation

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of traumatic events, human suffering and episodes of violence can lead to secondary traumatic stress (Acquadro et al. 2020). Depression, anxiety disorders, cardiovascular disease at a younger age, alcoholism, occupational burnout, post-traumatic stress disorder, or even the risk of suicide are more common among police officers than other professionals (Queiros et al. 2020; Acquadro et al. 2020; Demou et al. 2020; Ivleva and Pajarskienė, 2019; Purba and Demou 2019; Violanti et al. 2017; Wagner et al. 2020). Police officers who experience traumatic stress or already have symptoms of post-traumatic stress are more likely to experience chronic fatigue syndrome, fibromyalgia, indigestion, autoimmune disorders, chronic pain syndrome, complex psychological difficulties, social phobias and are more prone to drug use (McCainlies et al. 2014). It is pointed out that about 30% of police officers experience clinically significant symptoms of post-traumatic stress disorder at any time in their lives or fully meet all criteria for the diagnosis of post-traumatic stress disorder (Miller 2015).

The consequences of stress affect not only police officers and their families but also the organisation. These include increased absenteeism, refusal to perform certain tasks, decreased productivity, the slower work pace of police officers, poorer decision-making and increased complaints against officials (Miller 2015). Over time, stress can also affect the ability to protect communities, as well as increasing tensions between officials and community members (Miller 2015), and reduce public confidence in the work of police officers (Violanti et al. 2017). Research indicates that officers experiencing sleep disorders may make more administrative mistakes, fall asleep while driving or in meetings, violate safety requirements due to fatigue and have more anger when responding to offenders (Rajaratnam et al. 2011). Higher police officer vulnerability to stress and a variety of adverse above-mentioned stress-related outcomes require the search for an effective intervention for stress reduction.

Mindfulness-Based Intervention Related to Stress Reduction

An extensive discussion on how to define mindfulness has reached the understanding that it is a process of “openly attending, with awareness, to one’s experience in the present moment” (Creswell 2017, p. 492). It is stated that people can be mindful by noticing and accepting body sensations, emotions, thoughts and perceptual experiences. It is argued that a person who tends to perceive his inner experience in daily life has an opportunity to make a small pause before taking an action in the moment of a stress response. This action reduces stress in the short term and contributes to a person’s better psychological resilience in the long run (Alidina 2015). There are two types of practices helping to do so—formal and informal (Alidina 2015). Formal practices contain structured

exercises and often are done with a mindfulness trainer, while informal practices are the ones without a particular structure or exercises and encourage mindfulness in everyday life activities, for example, being mindful when eating or walking (Didonna 2009).

It has been shown that mindfulness practices activate neuronal networks in the somatosensory cortex, responsible for the processing of the environment senses, anterior cingulate cortex (which connects the limbic system with the brain cortex) and prefrontal cortex, which affects cognition, movement and decision-making (Tomasino and Fabbro 2016; Zeidan et al. 2015). Also, mindfulness practices reduce the activity of the amygdala; in that case, activation of the fight or flight response becomes less frequent (Taren et al. 2015). While some researchers suggest that practising mindfulness can induce the grey matter changes in a brain (Tang et al. 2020), a recently published study on two combined randomised controlled trials revealed that an 8-week (2 h a week) Mindfulness-Based Stress Reduction course did not make any changes in the brain structure (Kral et al. 2022).

Over the last decade, MBIs have become one of the most popular methods to help people reduce stress. According to the primary Mindfulness-Based Stress Reduction (MBSR) programme developed by Kabat-Zinn (1990), many researchers use an 8-week (2 h a week) mindfulness-based intervention to reduce stress in various samples. During the traditional eight weeks of MBI, individuals are trying different mindfulness techniques. Most of them include breathing exercises, body scan, mindful listening, sitting or moving meditation, and visualisation exercises (Blanck et al. 2018; Christopher et al. 2016; Krick and Felfe 2020; Trombka et al. 2018). Different MBIs could have various combinations of these and other techniques; however, the main criterion for selecting them for a particular intervention is the compliance of the techniques with the basic concept of mindfulness: the ability to notice what is currently happening to the person and in the environment. In the scientific literature, we can detect at least three MBIs that have been used for police officers: Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn 1990), Mindfulness-Based Resilience Training (MBRT; Christopher et al. 2016) and Mindfulness-Based Cognitive Therapy (MBCT; Segal et al. 2002).

MBSR is used for police officers’ stress management by focusing on two main goals: stress reduction and mindfulness skills improvement (Baer 2003). The participants of MBSR usually meet in a group for 2.5 h once a week and have a 1-day retreat (7-h mindfulness practice) between the sixth and seventh week. In addition, participants are encouraged to complete formal and informal homework tasks that are usually supported by audio recordings on all days except Sundays, with a minimum of 45 min per day (Kabat-Zinn 1990). In essence, the MBSR programme teaches people to accept their inner experiences without trying to suppress

or avoid them (Martín-Asuero and García-Banda 2010). Besides the already described MBSR programme, MBRT intervention was specially adapted to increase police officers' resilience and stress management to acute and chronic stress at work. It is also 8 weeks long, done in groups weekly for 2 h per session with an extended 6-h class in the seventh week. The structure of the meetings and the exercises used are similar to those in the MBSR programme; however, it focuses more on normalising the impact of stress and trauma, teaching adaptive habit development towards a reaction to stressors and encourages more group discussions among the participants in the session. The centre of attention of the exercises focuses specifically on work-related stress (Christopher et al. 2016). It has a daily homework practice of experiential mindfulness exercises related to the daily acts of police officers supplemented with several readings and journaling and an orientation session prior to 8-week training which focuses on the explanation of the physiology of stress response, the nature and mechanisms of mindful practices and the relevance on mindfulness training on lives of police officers (Christopher et al. 2016). Meanwhile, MBCT is based on cognitive-behavioural theory for stress management (Lao et al. 2016; Segal et al. 2002). This was initially developed to treat depression and is often used when working with mood disorders (Sipe and Eisendrath 2012). This programme consists of 8 group meetings of 2 h, usually once a week and includes both formal and informal mindfulness practices. The formal practices are like those used in MBRT, such as sitting meditation, breath awareness exercises and “body scan”. Individuals are also encouraged to practise mindfulness activities for at least 45 min per day, often using guided meditation recordings. During MBCT, individuals learn to recognise and accept negative thoughts related to stressors, so instead of ruminating about the problem or situation, they perceive it as less threatening (Sipe and Eisendrath 2012). Compared with other programmes, this gives more attention to educating police officers on their stress mechanisms (Hoeve et al. 2021).

To date, there is ample evidence of the benefits of MBIs for stress reduction. This type of stress reduction is effective in different groups: medical students (Daya and Hearn 2018) and employees (Burton et al. 2017; Melnyk et al. 2020), working individuals (Slemp et al. 2019), parents raising children with autism spectrum disorder (Cachia et al. 2016), teachers (Klingbeil and Renshaw 2018; von der Embse et al. 2019), prisoners (Auty et al. 2017) and other samples that are likely to experience greater stress levels in daily life. Studies have found that mindfulness-based interventions are effective in a sample of police officers as well; however, the evidence is scattered and needs synthesis. This systematic literature review aims to gather and summarise how well MBIs help police officers reduce stress.

Methods

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to process a systematic review (Liberati et al. 2009). Four electronic databases (SpringerLink, Web of Science, Academic Search Ultimate (EBSCO) and PubMed) were searched from each database's point of inception until July 2022. The literature search was conducted using a combination of the following keywords: (mindfulness OR mindfulness-based OR mindfulness-based interventions OR mindfulness intervention OR mindfulness-based stress reduction) AND (intervention OR training OR program) AND (police OR police officers OR law enforcement). Only articles in English published in peer-reviewed journals were searched. The search procedure was restricted by defining document type only as an article. The search was not limited by the date of publication or the region the research was conducted in.

Four inclusion criteria were as follows: (1) study involved police officers; (2) study used (quasi)experimental research design; (3) MBI was applied as the main intervention; (4) study presented pre- and post-intervention measures and quantitative results of stress. Exclusion criteria: (1) qualitative study design or other article types, not presenting primary quantitative results (e.g. opinion papers, commentaries); (2) stress change was not measured.

The names of the study authors, the country where research was conducted, data related to participants (age and gender), research design, study groups (number of participants), intervention (length and type), stress measurements, results related to stress, mindfulness and stress outcomes (sleep quality, health changes, etc.) changes were extracted manually. After extracting the necessary data and putting it into an online document, the content was reviewed again by two research authors to confirm/deny the relevance of the article.

Results

Selection of Studies

The PRISMA flow diagram in Fig. 1 refers to the process of identifying the relevant studies. Further, 223 records were identified from four databases: 86 from SpringerLink, 48 from Web of Science, 28 from Academic Search Complete (EBSCO) and 61 from PubMed. Although the search type was specified as an article, the databases still provided conference abstracts, seminars, or proceedings, which were removed ($n = 40$). Additionally, 59 duplicates were manually removed. At first, two authors of this review independently screened the titles and abstracts of all studies ($n = 124$). Any papers classified as irrelevant were removed

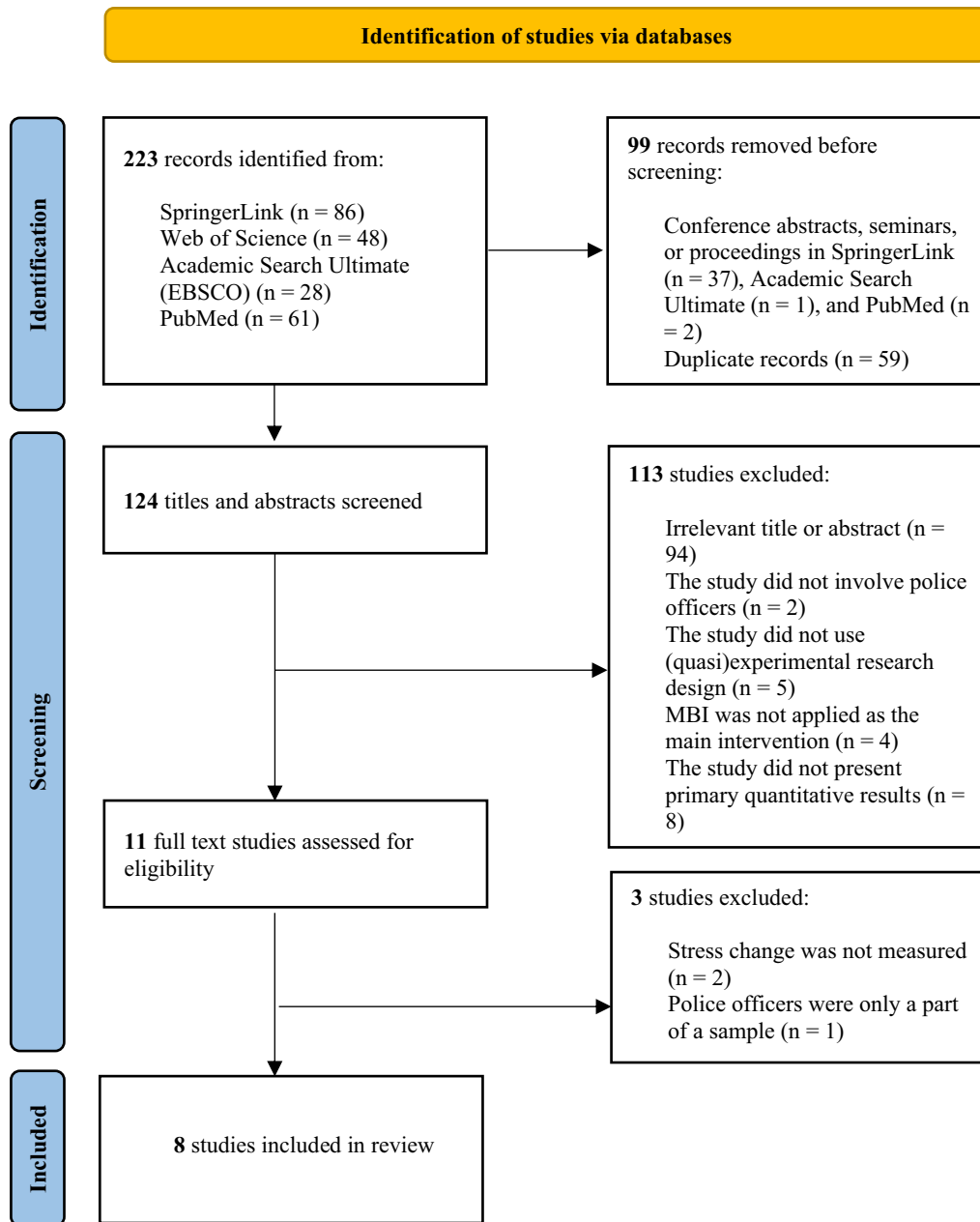


Fig. 1 PRISMA flow diagram

($n = 113$). When the study was identified as potentially relevant ($n = 11$), it was assessed for eligibility. Following this process, the potentially eligible paper was read in full, and then the decision on its suitability was made based on the inclusion/exclusion criteria. After this procedure, 8 articles were left as suitable for inclusion in the review. Two records were excluded because stress change in the intervention was not measured, and one included first-time responders where police officers were only a part of a sample. Additionally, the reference lists of all eight articles were screened, however more relevant articles were not found.

Characteristics of Studies

A total of 700 police officers (468 males and 232 females) constituted the initial sample, and 620 police officers' data were analysed across eight studies. The number of participants in a study varied from 25 to 267. Half of the studies had both an intervention and a control group, and another half had a one-group experimental design (only an intervention group). Of the two group experimental designs, three were randomised control trials (Christopher et al. 2018; Grupe et al. 2021a, b; Krick and Felfe 2020), and one had a quasi-experimental

design (non-randomised control trial) (Navarrete et al. 2022). It is also worth mentioning that three of the analysed studies specified their research as pilot studies (Christopher et al. 2016; Grupe et al. 2021a; Navarrete et al. 2022).

All studies included both genders and were done in Western countries. Three studies specified police officers working positions in detail (Christopher et al. 2018; Grupe et al. 2021a; Hoeve et al. 2021), two more abstractedly (Grupe et al. 2021a, b; Navarrete et al. 2022) and the other three just named the sample police officers and mentioned if some officers of command positions were included or not. The described working positions included patrol officers, detectives, criminalists, SWAT riot officers, forensic researchers, alarm room operators, human resource officers, sergeants, etc.

In seven of eight studies, participation was voluntary, and one study used a nonselective sample of police officers to avoid self-selection bias (i.e. to avoid only interested, open-minded, vulnerable individuals participating in a study) (Krick and Felfe 2020). Five studies mentioned participants' inclusion and exclusion criteria, and three did not have any or at least have not provided any information about it (Christopher et al. 2016, 2018; Krick and Felfe 2020). The inclusion criteria in four of the studies were that those police officers were able regularly to attend the class/mindfulness sessions (Grupe et al. 2021a; Hoeve et al. 2021; Marquez et al. 2021; Navarrete et al. 2022), and in one that participants are also willing to do homework assignments (Marquez et al. 2021). The exclusion criteria in two of the analysed studies were previous participation in MBSR or other mindfulness interventions or significant previous meditation experiences (Grupe et al. 2021a, b). This was not an exclusion criterion in one study, but this variable was controlled and included in the analysis (Navarrete et al. 2022). One study excluded potential participants if they had acute psychosis, had suicidal ideations, had current substance abuse problems or had a borderline personality disorder (Hoeve et al. 2021). Moreover, it is worth mentioning that one of the studies was implemented during the COVID-19 pandemic when there were a lot of safety measures in the workplace (Navarrete et al. 2022). Hence, all police officers wore masks during mindfulness practices.

All studies included self-reported stress measurements, and four had physiological stress measures. From self-reported measures, three measured subjectively perceived stress using the Perceived Stress Scale by Cohen and Williamson (1988) or Cohen et al. (1983). Five studies measured operational and organisational stress using the Police Stress Questionnaire by McCreary and Thompson (2006). Two studies measured perceived stress using the Stress subscale from the Depression, Anxiety and Stress Scale by Henry and Crawford (2005). One study measured physical stress by stress-related symptoms using the Somatisation subscale of the Four-Dimensional Symptom Questionnaire by Terluin et al. (2006). One study included the measurement of psychological strain using the Irritation scale by Mohr et al. (2005). From physiological

stress measures, three studies had salivatory cortisol measures (i.e. cortisol awakening response) (Christopher et al. 2016, 2018; Grupe et al. 2021a, b); one assessed hair cortisol concentration, diurnal cortisol slope and inflammatory markers (Grupe et al. 2021a, b); and one study measured heart rate (Krick and Felfe 2020)—a cardiovascular marker of the activity sympathetic nervous system.

Only four studies out of eight conducted a follow-up measurement: 3 months ($n=2$), 5 months ($n=1$) and 6–7 weeks ($n=1$). One study had a mid-intervention (Christopher et al. 2016) evaluation, and one had two assessments before MBI (baseline and pre-intervention) (Hoeve et al. 2021). Six out of eight studies presented participants' drop-out rates, which is essential in understanding the research quality and procedures. The drop-out rate ranged between 0 and 27.1% in the intervention group and between 1.75 and 56.1% in the control group. All the analysed studies reported effect sizes of the results.

Four of eight studies measured the acceptability of MBI using either quantitative or qualitative measures (Christopher et al. 2018; Grupe et al. 2021a; Marquez et al. 2021; Navarrete et al. 2022). All the studies where acceptability was measured stated that results showed high acceptance. The class attendance rate was reported in six of eight studies, and in sum up, overall attendance was around 80%. The length and frequency of homework practice were measured and reported in five studies out of seven, providing information about homework assignments. The average time for formal and/or informal practices outside the class was from 5.7 to 23 min per day. Only three studies reported information about the engagement in formal and/or informal practices after the intervention at follow-up (Christopher et al. 2018; Grupe et al. 2021a, b). One study calculated “dose–response” effects related to formal practices and their impact on stress and stress outcomes (Grupe et al. 2021a, b) (see Table 1 and Table 2).

Mindfulness Intervention

The length of MBIs varied between 6 and 8 weeks. All the studies applied a 2-h long session every week and five had an extended 4- or 6-h session during the 6th or 7th week. Finally, the Mindfulness-Based Resilience Training (MBRT) plan was used in two studies, while Mindfulness-Based Stress Reduction (MBSR) was used in two. Mindfulness-Based Cognitive Therapy (MBCT) was used in one study, two studies used mixed MBSR and MBRT intervention and one used a new MBI called Mindfulness to Promote Police Well-being.

Stress Outcomes

Studies revealed that MBIs reduce police officers' stress immediately after the intervention and after followed-up measurements. Results revealed that MBIs helped to reduce

Table 1 Summary of studies examining mindfulness-based stress interventions among police officers

Article authors	Country	Sample and design	Intervention type and length	The procedure (measurements, MBI structure)	Results: stress	Results: other measures
Navarrete et al. (2022)	Spain	Quasi-experiment (non-randomised controlled trial) Intervention group-21 participants (8 female, mean age=39±6.23), 1 dropped out Control group-41 officers (7 female, mean age=41.06±6.6), 23 dropped out	Eight weeks (2-h sessions per week). <i>Mindfulness to Promote Police Well-being</i> intervention was based on the Hölzel et al. (2011) model of mindfulness mechanisms	Measurements: pre-intervention and post-intervention assessments Self-reported stress measures: <i>Stress subscale of the Depression, Anxiety, and Stress Scale</i> (Lovibond and Lovibond 1995) The structure of the sessions was as follows: (1) guided meditation; (2) an inquiry process; (3) an analysis of the week's difficulties; (4) a brief theoretical explanation; and (5) guided meditation of the next daily homework meditation practice Homework practice: 20 min. formal meditation + informal practice once per day	Decreased perceived stress ($F=4.51^{***}$, $\eta^2=0.12$) between baseline and after the intervention	Increased mindfulness ($F=5.90^{***}$, $\eta^2=0.15$) and its component observing ($F=8.57^{***}$, $\eta^2=0.21$). Also increased self-compassion ($F=5.77^{***}$, $\eta^2=0.15$), and sleep quality ($F=6.99^{***}$, $\eta^2=0.18$). However, four facets of mindfulness did not change (nonreactivity, observing, act-aware, and describing), as well as suicidal ideation Decreased depression ($F=9.70^{***}$, $\eta^2=0.23$), anxiety ($F=7.31^{***}$, $\eta^2=0.18$), personal burnout ($F=7.99^{***}$, $\eta^2=0.18$), and work-related burnout ($F=7.23^{***}$, $\eta^2=0.18$). However, client-related burnout difficulties in emotion regulation did not change
Grupe et al. (2021a, b)	USA	Randomised control trial Intervention group-57 participants (34 female, mean age=40.2±7.4), 3 dropped out during intervention Control group-57 officers (24 female, mean age=39.8±9.3), 1 dropped out during research	MBSR/MBRT. Eight weeks (2-h sessions per week with an extended 4-h session in the seventh week)	Measurements: pre-intervention, post-intervention and 3-month follow-up assessments Self-reported stress measures: the <i>Police Stress Questionnaire</i> (McCreary and Thompson 2006), <i>Perceived Stress Scale</i> (Cohen and Williamson 1988) Physiological stress measures: salivary cortisol, hair cortisol concentration, inflammatory markers Practices for the experimental group included: body scan, walking meditations, mindful movement (including adapted yoga or tai chi), mindfulness of thoughts and emotions, mindful speaking and listening, mindful eating, and compassion practice; and inquiry in dyads, triads, or the full group about participants' experiences in practice Homework assignments from 9 to 20 min 6 day/week	After the intervention, perceived stress did not change, but it decreased at the 3-month follow-up ($t=-2.30^{**}$, Cohen's $d=-0.34$) Operational and organisational stress did not change after the intervention or at the 3-month follow-up Lower cortisol awakening response at 3 months follow-up ($t=-2.31^*$, $d=-0.33$). No effects on hair cortisol concentration, diurnal cortisol slope, or inflammatory markers	After the intervention, decreased PTSD symptoms ($t=-2.52^{**}$, Cohen's $d=-0.40$), anxiety ($t=-2.27^{**}$, Cohen's $d=-0.34$). Depression, fatigue, sleep quality, and pain intensity did not change At the 3-month follow-up, decreased PTSD symptoms ($t=-1.44^*$, Cohen's $d=-0.22$), anxiety ($t=-2.37^{**}$, Cohen's $d=-0.35$), depression ($t=-2.34^*$, Cohen's $d=-0.36$), fatigue ($t=-2.14^*$, Cohen's $d=-0.31$). Pain intensity and sleep quality did not change
Hoeve et al. (2021)	Netherlands	One-group experiment design Only the intervention group-82 participants (46 female, mean age=49±8.4), 19 participants dropped out	MBI developed by Williams and Cullen (2013) based on MBCT. Six weeks (2-h sessions per week)	Measurements: baseline, pre-intervention, post-intervention and 6-week follow-up assessments Self-reported stress measures: <i>Stress subscale of the Depression, Anxiety, and Stress Scale</i> (Lovibond and Lovibond 1995); <i>Somatization subscale of the Four-Dimensional Symptom Questionnaire</i> (Terluis et al. 2006); <i>Operational stress subscale from the Police Stress Questionnaire</i> (McCreary and Thompson 2006) Practices included: body scan, sitting meditation, object meditation, walking meditation, seeing meditation, sounds and thought meditation, befriending meditation, 3-min breathing space, and mindful yoga The participants received the book, audio-guided meditations, a workbook, and homework of each session Homework assignments 20 min a day	At post-test, reduced perceived stress ($t=-6.23^{***}$, Cohen's $d=-.64$) and physical stress ($t=-3.76^{***}$, Cohen's $d=-.29$). Operational stress did not change At follow-up (6 or 7 weeks after the training), significant improvement was found for perceived stress ($t=-6.08^{***}$, Cohen's $d=-.73$), physical stress ($t=-5.77^{***}$, Cohen's $d=-.52$), and operational stress ($t=-2.27^*$, Cohen's $d=-.28$)	After the intervention, reduced sleep difficulties ($t=-4.85^{***}$, Cohen's $d=-.56$). Increased positive affect ($t=4.40^{***}$, Cohen's $d=.47$), happiness ($t=4.48^{***}$, Cohen's $d=.34$), self-compassion ($t=5.40^{***}$, Cohen's $d=.47$), mindfulness ($t=4.61^{***}$, Cohen's $d=.38$) and all mindfulness components. PTSD symptoms and resilience did not change At follow-up (6 or 7 weeks after the training), reduced sleep difficulties ($t=-4.93^{***}$, Cohen's $d=-.48$), PTSD symptoms ($t=-2.60^*$, Cohen's $d=-.38$), Increased positive affect ($t=4.46^{***}$, Cohen's $d=.52$), happiness ($t=5.87^{***}$, Cohen's $d=.42$), self-compassion ($t=3.94^{***}$, Cohen's $d=.43$), and mindfulness ($t=4.33^{***}$, Cohen's $d=.44$) and all mindfulness components. Resilience did not change

Table 1 (continued)

Article authors	Country	Sample and design	Intervention type and length	The procedure (measurements, MBI structure)	Results: stress	Results: other measures
Krick and Felfe (2020)	Germany	2 × 2 experimental mixed design (randomised assignment into groups) 267 police officers (57 female, mean age = 25.96 ± 5.57) Intervention group—126 participants, control group—141. The information about dropouts is not provided	Mindfulness and resource-based worksite training (Krick et al. 2018). Based on MBSR and other MBIs. Six weeks (2 h per session per week)	Measurements: pre-intervention and post-intervention assessments Self-reported stress measures: the Psychological strain was measured by the <i>Irritation Scale</i> (Mohr et al. 2005) Physiological stress measures: heart rate (HR)—a cardiovascular marker of the activity of the sympathetic nervous system Practices included: mindfulness practices (e.g. breathing exercise, body scan), elements of mindful body movements and stretching, and cognitive education (i.e. knowledge of the stress process and resources, challenges, and achievements of mindfulness practices), while the control group had regular education courses. Control group received regular education courses in academy of public services Homework assignments: mandatory homework (did not control for participants' practice time)	After the intervention, decreased psychological strain ($F = 18.42^{***}$, $\eta^2 = .07$) HR: significant positive short-term effects in intervention group within Session 6 and positive long-term effects between Session 1 preintervention and Session 6 postintervention When compared to control group, only short-term positive effects in the intervention group (within Session 1 and 6) were significant	After the intervention, decreased negative affect ($F = 24.41^{***}$, $\eta^2 = .08$) and health complaints ($F = 19.89^{***}$, $\eta^2 = .07$). Increased mindfulness ($F = 101.21^{***}$, $\eta^2 = .28$), its subscales (act with awareness $F = 27.79$, $\eta^2 = .09$; non-judging $F = 15.66$, $\eta^2 = .06$, nonreacting $F = 56.09$, $\eta^2 = .17$; observing $F = 30.18$, $\eta^2 = .10$) and self-care ($F = 228.88^{***}$, $\eta^2 = .46$) Heart rate variability (HRV): significant positive short-term effects within Session 1 ($F = 13.96^{***}$, $\eta^2 = .08$), within Session 6 ($F = 95.78$, $\eta^2 = .38$); positive long-term effects: between Session 1 preintervention and Session 6 postintervention ($F = 181.67$, $\eta^2 = .55$), between Session 1 preintervention and Session 6 preintervention ($F = 77.50$, $\eta^2 = .34$); between Session 1 postintervention and Session 6 postintervention ($F = 103.39$, $\eta^2 = .41$) Significant improvements in HRV for the intervention group, whereas control group showed a decrease in HRV within Session 6 ($F = 18.87$, $\eta^2 = .11$)
Grupe et al. (2021a)	USA	One-group experiment design Only intervention group—30 participants (16 female, mean age = 38.40 ± 7.7). No dropouts (1 at 5-month follow-up)	MBSR/MBRT. Eight weeks (2-h sessions per week and extended 4-h class in the seventh week)	Measurements: pre-intervention, post-intervention and 5-month follow-up assessments Self-reported stress measures: the <i>Police Stress Questionnaire</i> (McCreary and Thompson 2006) Practices included: introduction to resilience and mindfulness and practising (i.e., 9-min, mindful movement/9-min body scan; exploration of physical posture, introduction to breath awareness practice) Homework assignments: 9–20 min, 6 days/week	Organisational stress reduced more for male vs. female officers after the intervention ($t = 2.59^*$, Cohen's $d = -0.37$) and at 5 months follow-up ($t = 2.13^*$, Cohen's $d = -0.76$) Police officers with less police experience showed greater declines in operational stress after intervention ($t = 2.01^*$, Cohen's $d = -0.42$) and after 5 months ($t = 2.70^*$, Cohen's $d = -0.66$)	Reduced burnout was observed for the Exhaustion (after the intervention ($t = -3.20^{***}$, Cohen's $d = -0.59$) and at 5 months follow-up ($t = -2.21^*$, Cohen's $d = -0.36$), but not for the Disengagement subscale of the Oldenburg Burnout Inventory. Reduced anxiety (after the intervention $t = -4.56^{***}$, Cohen's $d = -0.86$ and at follow-up $t = -4.59^{***}$, Cohen's $d = -0.76$), and negative affect (after the intervention $t = -2.92^{***}$, Cohen's $d = -0.52$). Increased psychological well-being (after the intervention $t = -2.19^*$, Cohen's $d = -0.39$). There was no change in positive affect and depression
Márquez et al. (2021)	Spain	One-group experiment design Only intervention group—25 participants (11 female, mean age = 45.63 ± 10.17). 5 participants dropped out	Based on MBSR. Seven weeks (2-h sessions per week, plus an additional 4-h session on the sixth week)	Measurements: pre-intervention and post-intervention assessments Self-reported stress measures: the <i>Perceived Stress Scale</i> (Cohen et al. 1983; Remor 2006) Practices included: conscious movements, breathing meditation, observation of bodily sensations, emotions and thoughts, and several group exercises Information about homework was not provided	After the intervention, reduced perceived stress ($t = 2.86^{**}$, Cohen's $d = .61$)	After the intervention, significantly increased mindfulness ($F = 7.44^{***}$, $\eta^2 = 0.73$) and its two components—observing and non-reacting (accordingly: $F = 44.9^{***}$, $\eta^2 = .71$; $F = 28.65^{***}$, $\eta^2 = .49$), compassion satisfaction ($F = 5.93$, $\eta^2 = .24$). Describing, acting with awareness, and not judging did not change

Table 1 (continued)

Article authors	Country	Sample and design	Intervention type and length	The procedure (measurements, MBI structure)	Results: stress	Results: other measures
Christopher et al. (2018)	USA	Randomised control trial The intervention group—31 participants (3 female, mean age=44.73±6.63), 7 dropped out Control group—30 officers (4 female, mean age=43.22±5.43), 5 participants dropped out	MBRT. Eight weeks (2-h sessions per week and extended 6-h class in the seventh week)	Measurements: pre-intervention, post-intervention and 3-months follow-up assessments Self-reported stress measures: the <i>Police Stress Questionnaire</i> (McCreary and Thompson 2006) Physiological stress measures: salivatory cortisol Practices for the experimental group included: body scan, sitting and walking meditations, mindful movement, and group discussion. Information about control group activities is not presented Homework assignments: no information about recommended length of home practises. However, the information that participants listened to guided meditations for an average of 10.62 min a day out of class is provided	Reduced organisational stress after the intervention ($F = -3.77^*$, Cohen's $d = .52$), while operational stress did not change At a 3-month follow-up, there were no changes in organisational or operational stress Reduced cortisol increases after awakening, while at the same time increased levels at awakening Reduced waking cortisol levels Increases post-training for male participants, and on day three post-training for both male and female participants	After the intervention, significant improvement in burnout ($F = 6.37^{**}$, Cohen's $d = .73$), and one mindfulness component—non-reactivity (pre- post-test $F = 4.22^*$, Cohen's $d = .60$). At a 3-month follow-up, there were no changes in burnout and non-reactivity After the intervention and at a 3-month follow-up, there were no changes in anxiety, depression, sleep difficulties, suicidal ideation, anger, aggression, and two mindfulness components (nonjudging, and acting with awareness)
Christopher et al. (2016)	USA	One-group experiment design Only the intervention group—59 participants (22 female, mean age=43.76±7.22), 16 participants dropped out	MBRT. Eight weeks (2-h sessions per week with an extended 6-h session in the seventh week)	Measurements: pre-intervention, mid-intervention, and post-intervention assessments Self-reported stress measures: the <i>Police Stress Questionnaire</i> (McCreary and Thompson 2006), <i>Perceived Stress Scale-4</i> (Cohen and Williamson 1988) Physiological stress measures: salivatory cortisol Practices included: body scan, sitting meditation, mindful movement, walking meditation, eating meditation, mindful martial arts exercises, and other elements of MBSR Homework assignments: daily homework practice of the experiential mindfulness exercises, supplemented with several readings and journaling and recommendation to include informal practices in their exercise regimen. No information about the recommended length of home practises	Decreased perceived ($F = 13.73^{***}$, $ES^{****} = .75$), organisational ($F = 9.86^{**}$, $ES^{****} = .72$) and operational stress ($F = 7.57^{**}$, $ES^{****} = .56$) No significant changes in cortisol across measurement periods (pre- and post-MBRT), and times after waking (0, 30, 45 min)	Decreased sleep disturbance ($F = 10.50^{***}$, $ES^{****} = .74$), anger ($F = 18.28^{***}$, $ES^{****} = .63$), fatigue ($F = 12.89^{***}$, $ES^{****} = .59$), burnout ($F = 13.70^{***}$, $ES^{****} = .74$), and difficulties with emotion regulation ($F = 6.60^*$, $ES^{****} = .74$) Increased mindfulness ($F = 24.66^{***}$, $ES^{****} = .70$) and its three facets (acting with awareness ($F = 18.90^{***}$, $ES^{****} = .87$), nonjudging of inner experience ($F = 13.44^{***}$, $ES^{****} = .73$), and nonreactivity to inner experience ($F = 25.74^{***}$, $ES^{****} = 1.19$); resilience ($F = 11.27^{***}$, $ES^{****} = .70$); emotional intelligence ($F = 6.90^{**}$, $ES^{****} = .74$), mental health ($F = 13.83^{***}$, $ES^{****} = .78$), and physical health ($F = 4.18^*$, $ES^{****} = .48$)

MBCT mindfulness-based cognitive therapy, MBRT mindfulness-based resilience training, MBSR mindfulness-based stress reduction. * $p < .05$; ** $p \leq .01$; *** $p \leq .001$; **** $p \leq .0001$; ES effect size (CI of difference score)

Table 2 Brief methodological characteristics of included studies

Article	Both genders participated	Voluntary participation	Follow-up	Information on dropouts	Control group	Class attendance information	Home practices measurement
Navarrete et al. (2022)	Yes	Yes	No	Yes	Yes	Yes (86% attended at least 6/8 sessions)	Yes (On average, 27/42 days (SD = 10.88) with an average of 23 min (SD = 8.57) per day)
Grupe et al. (2021a, b)	Yes	Yes	Yes (after 3 months)	Yes	Yes	Yes (Overall class attendance was 80.3%, with 53/57 participants attending more than 50% of the classes)	Yes (A median of 42 days of formal meditation practice over the 8 weeks (range = 0–55), and a median of 130 weekly practice minutes (8-week range = 0–2669). 43/54 participants assessed at follow-up reported some amount of practice after the class, with 41% reporting 2 or more weekly days of practice)
Hoeve et al. (2021)	Yes	Yes	Yes (after 6 or 7 weeks)	Yes	No	Yes (88% attended 5 or 6/6 training sessions)	Yes (49% meditated at least five times a week outside the training sessions)
Krick and Felfe (2020)	Yes	No	No	No	Yes	No	No
Grupe et al. (2021a)	Yes	Yes	Yes (after 5 months)	No dropouts	No	Yes (Overall class attendance was 85%, with no officers missing more than 3/8 classes)	Yes (Officers completed 91% of weekly practice logs and engaged in formal practice outside of class on average 43/56 days (SD = 9.3, range = 22–56), with an average of 83.8 total practice sessions (SD = 34.3, range = 32–170 occasions) and 870 average minutes of formal practice (SD = 417, range = 342–2140). Participants reported engaging in informal practices on average 43.2/56 days (SD = 12.6, range = 10–56), and over 8 weeks estimated an average of 179 informal practice instances (SD = 107, range = 31–497). At a 5-month follow-up 79% of participants reported continued formal practice on at least a weekly basis, with an average of 1.8 days/week of practice. 96% of participants reported engaging in informal practice or moments of mindful awareness at least daily)
Márquez et al. (2021)	Yes	Yes	No	Yes	No	Yes (14/22 attended all the sessions; 4 missed only one session; 2–two sessions)	No homework

Table 2 (continued)

Article	Both genders participated	Voluntary participation	Follow-up	Information on dropouts	Control group	Class attendance information	Home practices measurement
Christopher et al. (2018)	Yes	Yes	Yes (after 3 months)	Yes	Yes	Yes (Overall class attendance was ≥ 75%)	Yes (Participants engaged in an average of 322.35 min of out-of-class meditation practice (SD = 357.49; range = 1–1340) over the 8-week training, on an average of 13.85 (SD = 12.63; range = 1–44) out of a possible 56 days, with an average of 10.62 min per day (SD = 9.52; range = 1–77). Only 2 out of 24 MBRT participants endorsed any mindfulness practice from post-training to 3-month follow-up)
Christopher et al. (2016)	Yes	Yes	No	Yes	No	No	No

operational stress after the intervention (Grupe et al. 2021a, Christopher et al. 2016), 30 days after the intervention (Grupe et al. 2021a, b), 6–7 weeks after the intervention (Hoeve et al. 2021) and 5 months after the intervention, Grupe et al. 2021a). Organisational stress reduced after the intervention (Christopher et al. 2016, 2018; Grupe et al. 2021a), and 5 months after the intervention (Grupe et al. 2021a). The level of perceived stress declined after the intervention (Christopher et al. 2016; Hoeve et al. 2021; Márquez et al. 2021; Navarrete et al. 2022) and 6–7 weeks after the intervention (Hoeve et al. 2021). Physical stress reduced after the intervention (Hoeve et al. 2021), and 6–7 weeks after the intervention (Hoeve et al. 2021). Psychological strain also declined after intervention (Krick and Felfe 2020). Most of the studies reported medium-to-high effect size (i.e. Cohen’s d from 0.41 to 0.73 and η^2 from 0.07 to 0.51) (Watson 2021).

However, not all studies have revealed positive results for MBIs. Grupe et al. (2021a, b) revealed that operational and organisational stress did not change after the intervention, and at a 3-months follow-up, Hoeve et al. (2021) revealed that MBI intervention did not change operational stress, and Christopher et al.’s (2018) study showed that MBRT was ineffective in reducing operational stress.

Three studies also analysed objective (physiological) stress indicators, like cortisol and heart rate change. Grupe et al. (2021a, b) did not find significant results on hair cortisol, diurnal cortisol change and inflammatory markers. Meanwhile, Krick and Felfe (2020) found positive short-term effect on heart rates changes in experimental group participating in MBI. Finally, the results of salivatory cortisol changes are mixed: Grupe et al. (2021a, b) revealed lower cortisol awakening after 3 months, Christopher et al. (2018) revealed reduced cortisol increased after awakening, while the Christopher et al. (2016) study revealed no changes.

Other Outcomes

MBIs were not only effective in reducing stress but also helped to increase emotional intelligence (Canady et al. 2021; Christopher et al. 2016), self-compassion (Hoeve et al. 2021; Navarrete et al. 2022), psychological well-being (Grupe et al. 2021a), mindfulness components (e.g. awareness, non-judging) and mindfulness process (Canady et al. 2021; Christopher et al. 2016; Christopher et al. 2018; Hoeve et al. 2021; Krick and Felfe 2020; Márquez et al. 2021; Navarrete et al. 2022), happiness and positive affect (Hoeve et al. 2021). MBIs also helped to reduce sleep disturbance/increase sleep quality (Christopher et al. 2016; Grupe et al. 2021a, b; Hoeve et al. 2021; Navarrete et al. 2022), negative affect (Grupe et al. 2021a; Krick and Felfe 2020), burnout (Christopher et al. 2016, 2018; Navarrete et al. 2022) and exhaustion (Grupe et al. 2021a), PTSD symptoms (Grupe et al. 2021a, b; Hoeve et al. 2021), health complaints (Krick and Felfe 2020), heart rate variability (Krick and Felfe

2020), fatigue (Canady et al. 2021; Christopher et al. 2016; Grupe et al. 2021a, b), difficulties with emotions regulation (Canady et al. 2021; Christopher et al. 2016), depression and anxiety (Grupe et al. 2021a, b; Navarrete et al. 2022).

Discussion

The aim of this systematic review was to synthesise recent literature on the effectiveness of MBIs for stress reduction in a sample of police officers. The search procedure on four databases allowed us to identify eight relevant articles. This review suggests that mindfulness-based interventions reduce police officers' organisational, operational, physical, perceived stress and psychological strain, as well as increase mindfulness, reduce sleep disturbance, negative affect, PTSD symptoms, burnout and reduce other negative psychological stress-related outcomes.

We found that MBIs used in the police officers' sample varied from 6 to 8 weeks. As all the later developed MBIs were based on the primary MBSR programme developed by mindfulness pioneer Kabat-Zin, the length of interventions, which is 8 weeks long, has become traditional. However, some of the analysed interventions were shortened for better feasibility for police officers. Since police officers have hectic work schedules, it becomes challenging to convince command officers to allow the intervention to be carried out during work time and for participants to participate in it outside the working hours.

In addition to the traditional 8-week MBI, there are 1-day, 2-week or 4-week-long interventions that have been used with other samples (Matvienko-Sikar et al. 2016; von der Embse et al. 2019). Interventions usually consist of weekly 2-h sessions; however, the duration of one session can also vary from one minute (Westenberg et al. 2018) to 30 min (Stefanaki et al. 2015) or even 8 h (Ó Donnchadha 2018). As the researchers note, duration may also depend on the needs and opportunities of the target group participating in the intervention (Lunsky et al. 2017; Westenberg et al. 2018). Based on the results, we suggest that both, traditional 8-week long MBIs and shorter versions (6-week or 7-week) MBIs, help reduce police officers' stress.

A meta-analysis by Auty et al. (2017) revealed that longer-term but less intensive interventions (e.g. 10-week, weekly 30-min sessions) have a more significant positive effect than short and intense interventions (e.g. 3 weeks, weekly 8-h sessions). In this case, it would be suitable to organise and assess the effectiveness of less intense intervention (i.e. 15-min sessions per day) for police officers considering their work characteristics, i.e. the need to be ready for the call-out into service. Also, police officers might be less motivated to participate in an intervention if it is organised after working hours and not all police departments can organise a 2-h-long

intervention during working hours. However, studying the duration peculiarities of MBIs, especially short ones, requires more attention (Burton et al. 2017).

A quarter of the analysed studies used the MBRT plan, another quarter used MBSR and another quarter used a combination of MBSR and MBRT. MBSCT was used in one study, and one also used a new MBI called Mindfulness to Promote Police Well-being (Navarrete et al. 2022). Christopher et al. (2016) created MBRT for police officers' stress reduction and made some modifications for it to be closer to the culture of this profession. The authors indicated that for police officers, it is challenging to develop interpersonal discussions about their experiences when using classical MBSR (Christopher et al. 2018). This MBI focuses on explaining the physiology of stress response and its change in the state of mindfulness. Physiological stress-related information is usually more accepted and trustworthy for the members of this masculine occupation than psychology-related information. Meditation is also related to the daily acts or stressors experienced by police officers, and all exercises are adapted to the culture of police officers. It is also worth mentioning that studies which used MBI plans other than MBRT also stated that some adaptations were made in MBIs content and language to be more in sync with police officer culture. Still, to this day, it would be hard to say that one programme is better than another. It is also justified by the fact that all the reviewed interventions show good results in reducing stress and various stress-related consequences.

Even though all studies showed positive MBIs results on stress and stress-related outcomes, we noted some methodological differences that might be related to different types of results bias. First, only three of the analysed studies were randomised control trials. Others used one group experimental design, and one was a quasi-experiment when allocation to groups was not based on randomisation. One group experiments or non-randomised control trials are subjected to numerous threats to internal validity. Even though the authors believe that observed positive changes among study participants occurred due to MBIs, several alternative explanations for those changes might exist. Although it is hard to compare the results of randomised control trials and one group experimental design studies because of possible existing biases, different stress measures and small number of studies, the reported effect sizes of stress reduction in both study designs varied from medium to large.

So, future studies should apply a two-group experimental design by adding a control group into the research plan. Using only one experiment group, researcher(s) should always consider that external or internal factors may affect the intervention results, i.e. changed job characteristics, such as work schedule, or changed organisational components, e.g. a new leader could have decreased stress level in a workplace. A two-group design would allow researchers to control these changes in statistical analysis. We also noticed that not all

studies describe what has been done with the control group during the research (i.e. if the control group got another kind of intervention or experienced no intervention). Researchers are encouraged to provide more information about the control group and what researchers do with this group.

The number of participants in the analysed studies varied from 25 to 267. Small sample sizes always limit the statistical power, so even if the study has significant pre-post differences in the data, the results should be interpreted with caution and cannot be generalised to a general population that has been studied (Canady et al. 2021; Marquez et al. 2021). Also, only three of the analysed studies specified the working positions of police officers. It also challenges the generalisation of results because police officers working in different positions might face different stressors (for some, the most significant stressor might be low salary or night shifts, and for others—the frequent sight of violence). The samples of analysed studies also consisted of police officers from one or two departments. So, in future studies, bigger samples from multiple police departments and specified working positions or even more homogenous police officer samples in groups (i.e. only patrol officers or only criminalists) are encouraged. It will help to understand if and how the variability of organisational structure and culture or different working positions impacts the effectiveness of MBIs.

Most studies (seven out of eight) had convenience samples with voluntary participation. Although those samples probably respond to the needs of police officers, those who need help are getting it. However, we agree with Kirk and Felfe (2020) that such samples might influence the results and bias the reported effects while raising the question of whether those results could be generalised to all police officers. Participants who voluntarily agree to participate in a study probably are more motivated, have a positive attitude towards suggested intervention and probably have the expectation of improvement of their health. So, devoting their time to attending classes, doing homework assignments and wanting a positive effect might influence their perception and, in that way, the result of self-reported measures. Considering generalisation, contrary to voluntary participation, police officers are the ones that look at any psychological intervention with caution and doubt (Sharp et al. 2015).

Also, only half of the studies included feasibility and acceptance measures in their studies. It was reported that acceptance was relatively high based on the ratings of the statements about MBI's value to participants' life, the recommendation for others, continuity of mindfulness practices, etc., on a Likert scale. However, researchers assigned the evaluation to high when the average answer was higher than the mid-point of the scale (for example, the mean of answers was 4 and over on a 7-point Likert scale). Some authors also justified the feasibility by a high class attendance (overall class attendance in all studies was about 80%)

or a regular engagement in homework assignments. However, it is difficult to expect other results when the sample is voluntary, so participants are motivated.

MBSR and MBCT emphasise the importance of daily practice as an integral part of the program (Parsons et al. 2017). It states that practitioners should provide participants with homework, as it is believed to increase transferring of new skills to daily life. The pioneer of MBIs, Kabat-Zinn (1990), also notes that regular and sustained daily mindfulness practice is critical in maximising the therapeutic benefits of MBIs. However, we noticed that only 5 of 8 studies evaluated or tracked police officers' engagement in mindfulness practises between sessions. Only 3 of 8 measured the post-intervention engagement in practices at follow-up. One study did not have homework or at least provided no information about it (Marquez et al. 2021). Besides, only one study evaluated the effect of engagement in practice on stress and stress-related outcomes.

Based on the reports about the average engagement in homework practices (around 20 min per day), we can conclude that it is smaller than the standard requirement for MSBR/MBCT (45 min) (Parsons et al. 2017). As we can see from the data in Table 1, some researchers initially lowered the recommended time for home practice. It might be done because of mixed findings in the literature on associations between mindfulness practice on stress and clinical outcomes (Vettese et al. 2009; Parsons et al. 2017) and police officers' attitudes towards psychological interventions (Sharp et al. 2015). In future studies, it would be beneficial to identify the barriers specific to police officers related to MBI class attendance and homework practices and address them during training sessions.

Besides, homework monitoring that has been reported also has some limitations. None of the studies measured the quality of home practices; they just tracked frequency and length of it (in some cases, it was not tracked but self-reported). Also, no study reported the psychometric properties of monitoring methods. So, further research would benefit from developing valid and reliable methods for evaluating homework reporting and compliance with homework assignments.

When implementing MBIs, it is important to consider factors of organisational culture related to the perception of the police officer's profession, which promotes stoicism and emotional control (Grupe et al. 2021a). The police may be considered a masculine workplace, and police departments often have a specific organisational culture—police officers hardly accept psychological help, and perceive themselves as unbreakable, strong and able to cope with all problems. As Sharp et al. (2015) point out, about 60% of officers with mental health difficulties do not seek help. The most often cited reason is the stigma of turning to specialists (Hansson and Markstrom 2014). According to Argustaitė-Zailskienė and Žemaitienė (2016), police

officers report feeling uncomfortable if their co-workers find out they need psychological help, are more likely to think they may lose their job if their employer finds out they need psychological help and prefer to consult a psychologist outside the workplace. Moreover, while some police officers begin their careers in excellent physical health, some retire early or even die from work-related stress disorders (Waters and Ussery 2007). For practitioners, it is important to try changing police officers' attitudes towards mental health and cultural values that police officers must deal with their problems alone. Stigmatisation creates an atmosphere for mental health problems, like burnout, to occur more often in police officers' sample. Researchers are encouraged to measure police officers' attitudes towards interventions like mindfulness-based stress reduction to assess the impact of attitudes on the effectiveness.

It is also worth discussing the importance of setting and reporting a study's inclusion and exclusion criteria. The results showed that only five of eight studies clearly defined their inclusion and exclusion criteria. This information is important for better interpretation of study results and comparison of results because it gives information about the homogeneity or heterogeneity of analysed groups. One of the inclusion criteria in half of the studies was the ability to regularly attend classes. As discussed above, the inclusion of police officers who self-select to participate in a study is related to the doubts about the generalisability of study results. Moreover, only one study excluded participants with existing mental conditions. So, it might be that some individuals' response to the MBI was affected by their mental state. However, the results of all analysed studies were generally positive, and MBIs are widely supported for the treatment of a variety of mental health diagnoses, so it is unlikely that participants' mental conditions had a substantial impact on the results (Canady et al. 2021).

The present literature review revealed that MBIs also increased participants' mindfulness and some or all its components. These results, in general, confirm the internal validity of intervention because it helps to improve mindfulness per se. Suppose mindfulness intervention would not positively affect participants' mindfulness level. In that case, we could state that the intervention has flaws, a mindfulness training programme does not work and stress scores have dropped or remained high because of other factors, e.g. management changes. Considering these findings, researchers worldwide could use these results as proof that 6-, 7- and 8-week-long MBIs effectively increase mindfulness levels in police officers. However, as discussed earlier, a shorter and less intensive intervention plan should be tested because Canady et al. (2021) showed a positive effect of MBI of only 2.5 days duration, in a sample of first responders where police officers constituted part of the sample.

The results showed that only half of the studies followed up on MBI impact on stress and stress-related outcomes. Von Almen et al. (2015) state that follow-up measures determine the validity of study findings. MBIs are created to teach a person a skill that they could apply to daily life. As with all health-related interventions, the expectation is always a long-term, not a short-term outcome. By follow-up, researchers can assess an intervention's relative benefits and costs and examine programme effects across multiple later life outcomes (Hill et al. 2016). Also, concerning MBIs, some authors find positive outcomes or greater effects only at a follow-up. (e.g. Grupe et al. 2021a). So, without assessing follow-up, researchers might miss some critical results.

We found that different measures of stress were used across the studies. All the studies included self-reported stress measures, and half also had some physiological stress markers. In experimental psychology, the physiological measures are always encouraged near self-reported ones because it brings more objectivity to results. Between physiological stress, the cortisol awakening response was used most often, and between self-reported measures, operational and occupational stress was assessed most often (in 5 out of 8 studies) using the Police Stress Questionnaire (McCreary and Thompson 2006). Using the same measures is always helpful when comparing the study results.

It is also believed that national culture affects many life aspects and researchers suggest there are at least a few cultural differences. Studies selected for this systematic review were all conducted in Western countries; therefore, intervention effectiveness in diverse cultural settings may be different. For example, in more masculine cultures male officers would be more likely to drop out of the mindfulness intervention or be involved less because it is believed that men do not need help dealing with stress. So, more studies in other regions, i.e. Asia, and Africa, are required to better understand how mindfulness-based stress reduction intervention works. Additionally, reviewed studies suffer from the lack of the male/female ratio. Although it is known that more males work in the police, reviewed studies still lack comparison between genders.

Finally, not all studies revealed participants' dropout and attendance rates making it difficult to understand what part of the data was lost during the research and how attendance affected results. Not all studies providing dropout rates stated the reasons for it. Knowing the causes of dropping out would be helpful for other researchers to avoid that. Additionally, methods to reduce dropouts if they were used should be presented, and analysed.

From the analysis of drop-outs in studies that reported it, we could see that the more significant number of drop-outs was in the control group, usually set as a waiting list group (from 1.75 to 56.1) compared with an intervention group (from 0 to 27). Higher drop-out rates threaten the validity of study results (Bell et al. 2013). So, researchers

should explore the drop-out reasons, consider benefits for control group members and limit participants' burden and inconvenience when collecting data. It is always challenging to balance the competing goals of collecting sufficient data to support the research goals fully and not overloading participants with too long and detailed questionnaires. So, researchers should make the research plan feasible for the study population and create a drop-out management plan. Sometimes, drop-out appears for reasons that researchers could not control. It is rare in intervention studies, especially those requiring enough time and frequent visits, not to have drop-outs. So, researchers also should make a careful examination of the drop-outs and missing data (missing at random or not) and try to minimise bias by choosing appropriate analysis (Bell et al. 2013).

In our review, we also had one study where MBI was implemented during the COVID-19 pandemic and complied with all security requirements, i.e. temperature checks before entering the class, doing meditations with face masks, etc. Even though the authors give all the information related to the procedure, since experts say that we will live with COVID-19 for a while, it would be valuable to evaluate MBIs' impact not only on the change of perceived, occupational or operational stress but also to COVID-19 related stress. Also, it would be valuable to explore how COVID-19-related stress, for example, the fear of getting the disease, affects engagement in MBI classes and practices.

As with every systemic review, this one has limitations. The analysed research was conducted only in Western countries. Also, only English articles were searched and included in the literature review. Different kinds of MBIs and stress measures were used in the studies. However, we tried to take this into account when presenting the results. Finally, the samples of police officers might differ between the studies. There are different law enforcement systems worldwide, where police officers have different functions and responsibilities. For instance, in the UK, there are different kinds of warranted police officers (with powers of arrest) and police community support officers. However, it could be noted that authors rarely describe the work positions of participants.

We also noticed that some studies presented not all data and results. The authors mentioned that they collected some more data and described what kind. They also stated that those results would not be presented in the same publication but have been collected for a more extensive study or that data analysis of some particular aspects is ongoing. In that case, we lacked a broader picture related to the lack of results that have not been presented yet. This issue might be related to the limits of the number of characters allowed in a publication in a particular journal or the need for researchers to prepare publications to keep their ongoing research position, academic degree or pedagogical academic title. However, this systematic review assessed the MBIs' efficacy for

police officers' stress reduction and gave an insight into the methodological quality of the interventions and studies of their effectiveness that have been implemented already.

Conclusions

This systematic literature review aimed at synthesising recent literature on the effectiveness of MBIs for stress reduction in a sample of police officers. The review reveals that MBIs are effective in helping police officers to reduce organisational, operational, subjectively perceived, physical stress, and psychological strain and improve some biological stress markers. Additionally, it helps decrease psychological stress-related symptoms, i.e., PTSD, improves sleep quality, etc. The analysis revealed some limitations and methodological issues of implemented studies and made some suggestions for future research.

Funding No funding was received.

Declarations

Ethics Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest The authors declare no conflict of interest.

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