School-Based Mind–Body Interventions: A Research Review

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Abstract

This paper contains a narrative review of the literature in the field of school-based mind–body interventions (MBIs). The aim of the current review is to verify whether the school-based MBI programs implemented in primary and secondary schools over the past 5 years are effective in helping schoolchildren cope with stress-related, behavioral, and affective issues, as well as improve stress response and school performance. All articles were retrieved using a number of databases. Inclusion criteria comprised qualitative and quantitative, English language, and peer-reviewed studies among third graders (8–9 years old) to twelfth graders (17–18 years old), including special needs pupils. Qualitative studies were limited to pupils' experience only. Ten studies meeting the criteria for this review were assessed. The school-based interventions included yoga-based programs and mindfulness training. Evidence was evaluated and summarized. Across the reviewed studies, we found support for MBIs as part of school curricula to reduce negative effects of stress and promote overall well-being with caveats to consider in choosing specific programs. The practical implications of the current review include considerations related to the incorporation of MBIs in school curricula, which would likely benefit schoolchildren.

Keywords Mind–body intervention · Stress management · School performance · Affect regulation · Behavioral disturbances

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Introduction

Mind–body interventions (MBIs) are based on a number of practices designed to work on a physical and mental level in such a way as to enhance the mind's positive impact on the body (Rossi et al. 2006, 2011). They include ancient practices for self-care and well-being such as meditation, yoga, and tai chi, as well as more modern western practices, such as hypnosis, autogenic training, mindfulness, biofeedback, guided imagery, arts therapy, relaxation training, and psychological therapies. The list is ever growing and includes new practices developed over the past few decades that integrate psychology, consciousness, and body movement such as eye movement desensitization reprocessing (Chen et al. 2018; Fernandez and Faretta, 2007), mind–body transformation therapy (Cozzolino 2016; Cozzolino et al. 2020; Cozzolino et al. 2020; Rossi et al. 2013), and brain wave modulation technique (Cozzolino et al. 2020; Cozzolino and Celia 2016). Despite theoretical and practical differences in these approaches, they are all meant to promote the mind–body connection.

A growing body of research suggests that MBIs can have a number of positive effects on both healthy and clinical subjects, including the reduction of perceived stress (Gallego et al. 2016; Lolla 2018; Noordali et al. 2017; Paul et al. 2013), decreases in anxiety and depression (Gallego et al. 2016; Jeitler et al. 2017; Noordali et al. 2017; Paul et al. 2013; Regehr et al. 2013; Veehof et al. 2016), or improvements in chronic illness (Buric et al. 2017; Carlson et al. 2017; Montgomery et al. 2017; Paul et al. 2013). On the other hand, it must be noted that negative side effects were found in some participants of these interventions. In a review (Cramer et al. 2013), yoga was found to cause adverse events that mainly affected the musculoskeletal, nervous, or visual system. Moreover, mindfulness treatments can cause people to forget or dismiss thoughts that may be beneficial or protective if remembered (Wilson et al. 2015).

Even though research seems to indicate that mind–body techniques are effective in enhancing psychologic and physical health, there is still poor understanding of the underlying mechanisms (Buric et al. 2017). The efficacy of mind–body practices seems to be associated with their capability of reducing the sympathetic physiological response to stress by activating the parasympathetic branch of the autonomic nervous system (ANS) and by regulating the hypothalamic–pituitary–adrenal axis (Sawni and Breuner 2017). Moreover, they are also shown to increase neuroplasticity, heart rate variability, EEG synchrony, and oxygenation (Buric et al. 2017; Lee et al. 2015; Murata et al. 2004). In recent years, the effects of yoga, mindfulness, mindful meditation, and therapeutic hypnosis have also been investigated by functional magnetic resonance imaging (fMRI) studies (Aleksandrowicz et al. 2006; Desai et al. 2015; Falcone and Jerram 2018; Ives-Deliperi et al. 2011). As these neuroimaging studies suggest that these practices have a positive impact on the cerebral systems governing attention and are also capable of inducing positive changes to mental and behavioral experience.

Evidence also suggests that the mind and body communicate through neurochemical and immunological pathways (Atkinson et al. 2010; Celia 2020; Cozzolino et al. 2017; Cozzolino et al. 2020; Sawni and Breuner 2017; Venuleo et al. 2018). Recent research in this field has focused on epigenetic mechanisms, that is to say molecular processes modulating gene expression, which can induce long-term changes in the genome (Cozzolino et al. 2017; Kanherkar et al. 2017; Rossi et al. 2006, 2011). Epigenetic mechanisms regulate the interaction between genes and environment through the so-called activity or experience-dependent genes, which become active when they capture environmental, psychological and social cues (Battuello

et al. 2012; Cozzolino et al. 2017; Cozzolino et al. 2020; Rossi et al. 2008). These studies indicate a correlation between mind–body practices and epigenetic state (Kanhkar et al. 2017). Therefore, it is hypothesized that MBIs help control or change the expression of inflammatory genes (Buric et al. 2017). Consequently, this mind–body effect also has a positive impact on the processes underlying specific diseases (Cozzolino et al. 2015; Cozzolino et al. 2020).

Notwithstanding a growing number of studies on adult populations, some research indicates that there are relatively few studies on the effects of these interventions within a school setting (Bennett and Dorjee 2016; Šouláková et al. 2019). School-based MBI programs are typically aimed at improving well-being and preventing mental illness among children and adolescents.

Crucial developmental transitions, such as physical growth and cognitive, language, and moral development, take place during childhood and adolescence. Over this time, individuals have to solve problems and find opportunities related to schooling and personal life (Alivernini et al. 2019; Duprey et al. 2018; Girelli et al. 2019, 2020; Lucidi et al. 2019). In doing so, they develop behaviors that will probably last over the entire course of their lives. It is no surprise, then, that many adults' mental issues have their onset during developmental years, when children and adolescents spend many hours at school (Girelli et al. 2018; Kessler et al. 2007). A great number of chronic mental illnesses have an early onset prior to 14 years, with anxiety disorders emerging at around 7, and suicide rates being particularly high in adolescence (Šouláková et al. 2019).

Since school-based MBIs are aimed at enhancing mental health, they may play a very important role in helping schoolchildren cope with several mental and physical conditions such as chronic illness, anxiety, depression, phobias, anger, grief, bereavement, etc. (Rocco et al. 2018; Sawni and Breuner 2017). This is consistent with findings from a recent meta-analysis of mindfulness-based interventions among youth (Klingbeil et al. 2017) where these interventions exhibited small, positive effects comparable to those obtained in clinical settings.

Moreover, MBIs imply teachable skills that children and adolescents (if not severely mentally impaired) can learn without great effort, and, if administered by trained professionals, they are safe and functional (Sawni and Breuner 2017).

Mind–body interventions in school settings can be carried out in several ways. They can be used with a single individual or with groups of students who are experiencing difficulties; as regards timing, they can be conducted in the classroom setting during regular class time, over lunch or during study breaks, or even throughout the school environment (Šouláková et al. 2019). Schools often choose to implement the type of intervention that best fits their needs and is most approved by school personnel and parents.

Owing to the importance of the matter, we conducted this narrative review to verify whether the mind–body programs implemented in primary and secondary schools over the past 5 years, included in this review, support the hypothesis that these programs are effective in helping schoolchildren cope with behavioral and affective issues, as well as improve stress response and school performance. The practical implications of the findings of this review include considerations related to the incorporation of MBIs in school curricula.

Method

An extensive literature search was conducted using Scopus, Web of Science Core Collection, and PubMed. The databases were searched for the following keywords: school-based mind–body intervention, stress management, school performance, affect regulation,

behavioral disturbances. Inclusion criteria comprised qualitative and quantitative, English language, peer-reviewed studies focusing on the effects of school-based mind–body interventions on stress, performance, behavior, and affect among third graders (8–9 years old) to twelfth graders (17–18 years old), including special needs pupils. Qualitative studies were limited to pupils' experience only. We chose such inclusion criteria based on our research interest to prepare the grounds for our future studies. In fact, our line of experimental research includes investigation of innovative neuroscientific based mind–body techniques (Cozzolino et al. 2020; Cozzolino et al. 2020; Cozzolino et al. 2020) among university students, which we are planning to experiment with schoolchildren as well. Moreover, in order to provide a state-of-the-art picture of the designated subject, time restraint was applied, and articles were chosen dating from 2015 to 2019. In the references chosen, mind–body therapies were used either alone or as an adjunct to other interventions. In the case of control studies, control groups were exposed to several conditions, ranging from no intervention to regularly scheduled physical education. Overall, 115 references were found using the keywords and the time restraints chosen. Of the 115 references found, 68 were excluded based on the article title, and 47 were considered based on relevance. Out of the 47 references, 33 studies were selected based on the abstract. Applying the selection criteria led to the exclusion of 23 of those studies. Within those studies, nine were excluded, because they were reviews or meta-analyses, seven were non-school-based, and seven fell outside the time range chosen (Fig. 1).

Results

A total of ten studies met the inclusion criteria and were reviewed for this article, gathering a total of 858 patients (Table 1). Of these, nine were conducted in the USA, and one in Israel. Both qualitative and quantitative studies were included; while four of the studies were randomized controlled trials (RCTs), as summarized in Table 2, the others were mostly quasi-experimental studies, as summarized in Table 3. The number of participants varied from a minimum of 20 to a maximum of 211 subjects. Of the ten studies selected, three were related to elementary school students (Butzer et al. 2015; Keller et al. 2019; Tarrasch 2018); three included middle school students (Butzer et al. 2017; Butzer et al. 2017; Frank et al. 2017); one was related to sixth grade students only (Kang et al. 2018); two included high school students (Butzer et al. 2015; Fishbein et al. 2016); and one was related to elementary to middle school students (Sarkissian et al. 2018). Overall, three of these studies were related to students with special educational needs: one was carried out in a high-poverty area (Frank et al. 2017), one was related to high-risk adolescents (Fishbein et al. 2016), and another was related to students with a specific learning disability (Keller et al. 2019).

As to the type of intervention, the majority of the studies reviewed in this paper included yoga-based programs, such as the kripalu yoga in the schools (KYIS) curriculum (used in two studies), your own greatness affirmed (Y.O.G.A.) for youth, yoga for classrooms (Y4C), mindful yoga, and transformative life skills (TLS). Although these programs are based on spiritual practices, they are all completely secular and do not endorse any kind of spiritual orientation. The KYIS program curriculum aims to stimulate affective regulation, relational competence, and self-confidence. It includes Kripalu yoga techniques such as self-observation without judgment, self-regulation, and compassion meditation (Butzer et al. 2017). The Y.O.G.A. for youth program includes yoga and meditation. It aims at

Fig. 1 Flow diagram of the study

giving youth tools for self-discovery, and also helps them to focus mentally in order to fulfill “their own greatness” (Sarkissian et al. 2018). The Y4C program includes the key aspects of classical yoga and focuses on self-regulation (Butzer et al. 2015). The mindful yoga curriculum includes key mindfulness principles (e.g., concentration on breath, a non-judgmental attitude, cognitive and emotional awareness, etc.) and the use of mindfulness skills to cope with stressful situations. The yoga style is hatha vinyasa flow (Fishbein et al. 2016). The TLS program is a classroom-based program that includes yoga exercise, breathing, and meditation to reduce stress and stimulating physical and emotional wellness (Butzer et al. 2015). The remaining studies included mindfulness-based stress reduction (MBSR) and mindfulness meditation techniques. MBSR includes the practice of exercises aimed at promoting awareness of physical, emotional, affective, and cognitive states. The exercises include challenges that require children to practice mindful walking or mindful eating (Tarrasch 2018). The mindfulness meditation techniques include breathing, and cognitive, affective, and body awareness exercises. They may also include meditation sessions (Kang et al. 2018).

The mind–body interventions assessed in these studies varied in program duration and frequency of sessions, from one to four times a week over periods of 6 weeks to

Table 1 Description of selected studies

First author	Year	Topic/focus/question	Study design	Sample population	Size	Country
Butzer, B.	2017	Yoga for preventing substance use risk factors	Randomized controlled trial	Middle school students	211	USA
Butzer, B.	2017	Qualitative examination of yoga	Qualitative research	Middle school students	21	USA
Butzer, B.	2015	Effects of a classroom-based yoga intervention on cortisol and behavior	Single group, uncontrolled pilot study	Elementary school students (second and third grade)	36	USA
Butzer, B.	2015	Yoga may mitigate decreases in high school grades	Exploratory examination	High school students (ninth and tenth grade)	95	USA
Fishbein, D.	2016	Behavioral and psychophysiological effects of a yoga intervention on high-risk adolescents	Randomized controlled trial	High school students (ninth to twelfth grade)	85	USA
Frank, J. L.	2017	Effectiveness of a yoga program	Randomized controlled trial	Middle school students in high poverty area	159	USA
Kang, Y.	2018	Gender differences in response to a mindfulness training intervention	Pretests, posttests, and demographics	Sixth grade students	100	USA
Keller, J.	2019	Mindfulness and speed testing	Randomized controlled pilot trial	Second to fifth grade students with a specific LD	20	USA
Sarkissian, M.	2018	Effects of a Kundalini yoga program on stress, affect, and resilience	Quasi-experimental, single-group, pre-post	Elementary and middle school students	30	USA
Tarrasch, R.	2018	Effects of mindfulness practice on attentional functions	Quasi-experimental, single-group, pre-post	Third, fourth, and fifth graders	101	ISRAEL
LD learning disabilities					858	

Table 2 Summary of randomized controlled trials using MBIs in children

First author	Year	Basic demographics	Sample population	MBI	Description of intervention	Instruments used	Findings
Butzer, B.	2017	Seventh graders; 63.2% females; mean age: 12.64 (SD = 0.33)	211 EG; 117; CG; 94	Kripalu yoga in the schools (KYIS) curriculum	32-session intervention; 1–2 sessions per week over 6 months	BRUMS; PSS; UPPS-P Impulsive Behavior scale; The 5-item Soothability scale of the Kendall-Wilcox Self-Control Schedule; CAMS; CSMS; 13 willingness questions based on YRBS-MS; YEQ	Beneficial effects preventing males' and females' willingness to smoke cigarettes, improvement of emotional self-control in females
Fishbein, D.	2016	Ninth-twelfth graders; mean age = 16.7 years	85 (EG:45; CG:40)	Mindful yoga	20-session intervention; 50-min classes three times a week	PARQ; ACASI; ADI; RSQ; FFMQ; Brunel Mood Scale; DUSIR; BASC-2; SCT	Trends toward decreased alcohol use, improved teacher-rated social skills; non-significant increase in arousal in response to relevant stimuli as measured in skin conductance
Frank, J. L.	2017	Sixth and ninth grade; 46.5% female	159	Transformative Life Skills (TLS)	30-min instructional sessions 3–4 days per week during the first semester of the school year	School Engagement Scale; Student Academic and Behavioral Records; Attitudes Toward Violence Scale; PANAS-C; RSQ; CBCL	Significant reductions on unexcused absences, detentions, and increases in school engagement. Significant increases in student emotion regulation, positive thinking, and cognitive restructuring in response to stress

Table 2 (continued)

First author	Year	Basic demographics	Sample population	MBI	Description of intervention	Instruments used	Findings
Keller, J.	2019	Second through fifth graders	20	Mindfulness-based training	10–15 min daily of computerized training using research-based software; 30–45 min of literacy instruction and mindfulness	DIBELS; a writing task; the lexical decision task; The Six Traits Writing Rubric; Heart rhythm coherence biofeedback	Significant increase in response times during decoding and lowered heart rate; qualitative analysis revealed themes pointing to improvements in literacy and affect

ACASI Audio Computer-Assisted Self-Interview, ADI Abbreviated Dysregulation Inventory, ANT-C Attention Network Test, BASC-2 Behavior Assessment Scale for Children: Second Edition, BRUMS The Brunel University Mood Scale, CAMS Children's Anger Management Scale, CBCL Child-Behavior Checklist, CG control group, CSMS Children's Sadness Management Scale, DIBELS Dynamic Indicators of Basic Early Literacy Skills, DUSI-R Drug Use Screening Inventory-Revised, EG experimental group, FFMQ Five Facet Mindfulness Questionnaire, PANAS-C The Positive and Negative Affect Schedule for Children, RSQ Response to Stress Questionnaire, SCT Stop-Change Task, YEQ Yoga Evaluation Questionnaire, YRBS-MS Youth Risk Behavior Survey (2014)

Table 3 Summary of non-randomized controlled trials using MBIs in children

First author	Year	Basic demographics of population	Sample	MBI	Description of intervention	Instruments used	Findings
Butzer, B.	2017	Middle school adolescents	16	Kripalu yoga in the schools (KYIS) curriculum	32-session intervention; 35-min sessions 1/2 times weekly for 6 months	Post-intervention qualitative interviews; YEQ	Student reported beneficial effects on relaxation, stress, mood, self-regulation, social interaction, sleep, substance use, and academic performance; student opinions were generally positive, although somewhat mixed
Butzer, B.	2015	Second and third graders (55% males)	36	Yoga for classrooms (Y4C)	30-min sessions for 10 weeks	ANT-C and ELISA	A significant drop in cortisol levels in the 2nd graders; all participants showed improvement in behavior and ability to control anger and to deal with stress/anxiety
Butzer, B	2015	Ninth and tenth graders	95 EG: 44 CG: 51		12-week intervention; 35- to 40-min sessions two to three times per week, instead of regularly scheduled PE sessions	Cumulative grade point average (GPA)	Beneficial short-term effects on GPA were found, particularly while yoga was being practiced regularly

Table 3 (continued)

First author	Year	Basic demographics of population	Sample	MBI	Description of intervention	Instruments used	Findings
Kang, Y.	2018	Sixth graders; 54% males; Mean age: 11.79, (SD = 0.41)	100 EG: 52; CG: 48	Mindfulness meditation	Short sessions 4/5 times per week, in addition to Asian history. The control group received matched experiential activity in addition to African history with no meditation component, over 6 weeks	STAI-C; CAMS-R; SCS	Improvement in emotional well-being; female meditators reported greater increases in positive affect compared to females in the control group, male meditators and control males displayed equivalent gains. Also, females showed increases in self-reported self-compassion associated with improvements in affect
Sarkissian, M.	2018	Elementary and middle school students	30	Your own greatness affirmed (YOGA) for Youth	10-week program 1/2 times per week; informal qualitative interviews with schoolteachers, yoga teachers, and students	PSS; PANAS and the Resilience Scale	Significant improvement in students' stress, positive affect, and resilience; qualitative results indicated that students, schoolteachers, and yoga teachers all found the program to be beneficial for students' well-being
Tarrasch, R.	2018	Third, fourth, and fifth graders; mean age 4th grade: 10.1, (SD = 0.3); 3rd and 5th grade: 10.17 (SD 1.01)	100 EG: 58; CG: 42	Mindfulness-based stress reduction (MBSR)	10-week mindfulness workshop delivered in small groups of 3–4 pupils	CPT; the Conjointive Visual Search Task	An improvement in attentional capacities

ANT-C Attention Network Test, *CAMS-R* Cognitive and Affective Mindfulness Scale-Revised, *CG* control group, *CPT* Computerized Continuous Performance Task, *ELISA* enzyme-linked immunosorbent assay, *EG* experimental group, *PANAS* The Positive and Negative Affect Schedule, *PSS* The Perceived Stress Scale, *SCS* Self-Compassion Scale, *SDQ* Goodman's Strengths and Difficulties Questionnaire, *YEQ* Yoga Evaluation Questionnaire

6 months. Some of these studies indicated that MBIs could have a positive impact on students' behavior and stress management. In a study carried out by Butzer et al. (2015) on the effects of a 10-week classroom-based yoga intervention on cortisol concentrations and perceived behavior in second and third graders, results revealed a significant decrease in cortisol levels in the second graders only, and improvement in behavior and ability to control anger and to deal with stress and anxiety in all participants, though the third graders showed fewer improvements than the second graders. Furthermore, a study by Frank et al. (2017) aimed at assessing the effectiveness of a yoga-based social-emotional wellness promotion program (TLS), on emotional distress, prosocial behavior, and school functioning in adolescents attending an inner-city school district. Results suggested significant reductions in the number of unexcused absences and incarcerations. Moreover, significant increases were found in student emotion regulation, positive thoughts, and stress coping. As to the measures of physical symptoms, suspensions, school grades, and overall affect, there were no significant effects. Qualitative data were obtained through student reports. Most participants showed appreciation for the intervention and also found it to be effective with regards to social behavior.

Other studies from this review suggested the effectiveness of MBIs on cognitive functioning and academic performance. A study (Tarrasch 2018) investigated the effects of mindfulness practice on sustained and selective attention in small groups of primary school children. The intervention group received a 10-week mindfulness intervention. Results revealed significant improvement in both sustained and selective attentional tasks and a general reduction in impulsivity in the experimental group as compared to the control group. These results clearly bear crucial implications for children's wellness and school functioning. Another study (Butzer et al. 2015) evaluated how a 12-week school-based yoga intervention influenced grade point average in ninth and tenth grade students. Although both groups showed a decline in grade point average, the control group showed a significantly greater decline than the yoga group. Both groups exhibited comparable declines once the yoga intervention was over. These results suggest that yoga may prevent declines in grade point average, but these effects may not endure after the intervention is over. A study by Keller et al. (2019) evaluated the effects of a mindfulness-based training on reading ability scores and attitudes in children with learning disabilities. Participants were assigned to either an active control or a 5-week mindfulness-based intervention. Results of the quantitative analysis indicated a significant rise in response times during decoding and lowered heart rate. The themes that emerged from qualitative analysis indicated improvements in reading ability and general affect.

Another group of studies from this review focused on the efficacy of MBIs in reducing cigarette smoking and substance use in high-risk adolescents. A pilot randomized controlled trial (Fishbein et al. 2016) was conducted to test the efficacy of a 20-session mindful yoga intervention for reducing substance use in students at high-risk for dropping out. Results showed that the yoga group, as compared to control, were less willing to use alcohol and also received more positive social skill ratings from teachers. Yet, there were no significant effects on impulsivity, affect, or engagement coping. In a similar vein, Butzer et al. (2017) conducted a randomized controlled trial to test whether yoga was effective in reducing risk factors for substance use in seventh grade students. The intervention consisted of 32 yoga sessions as compared to physical-education-as-usual in the control group. Results indicated that immediately after the intervention students in the control group, compared to the yoga group, were significantly more eager to attempt to smoke cigarettes. Findings also suggested that school-based yoga might

have beneficial effects on smoke prevention in male and female adolescents. Moreover, improvement in emotional self-control was found, but only in females.

Other studies reviewed in this paper focused on the effectiveness of MBIs on students' positive affect, resilience, and well-being. As a part of a group randomized controlled trial (Butzer et al. 2017), a qualitative examination of yoga (Butzer et al. 2017) was conducted considering how student perceived yoga in terms of such aspects as practicality, ease of learning, and direct results. Findings were mixed. Very positive opinions were related to the effects of yoga on stress, sleep, and relaxation, whereas generally positive opinions were related to affective self-regulation, sociability, substance use, and academic performance. Likewise, another study (Sarkissian et al. 2018) was carried out in urban inner-city schools, where disadvantaged children at high risk of behavioral and emotional problems were attending. The intervention consisted of a 10-week YOGA for Youth program aimed at investigating the effects of the program on student stress, affect, and resilience. The study also included informal qualitative interviews with schoolteachers, yoga teachers, and students to understand how the program was perceived. The quantitative results revealed significant improvement in stress, affect, and resilience in the participants. As for qualitative results, all participants (including schoolteachers and yoga teachers) reported that the program had improved students' well-being. Moreover, a study by Kang (Kang et al. 2018) investigated gender as a possible moderator for emotional effects in response to school-based mindfulness training. The goal of the study was to improve emotional well-being in early adolescents. The intervention group completed short mindfulness meditation sessions as an adjunct to history teaching, whereas the control group received paired experiential activity in addition to history teaching from the same teacher without meditation. Pre- and post-intervention self-reported measures of emotional well-being, mindfulness, and self-compassion were acquired. Results show that the intervention group reported greater improvement in emotional well-being compared to the control group, with important gender differences. Female meditators, in fact, showed greater gains in positive affect compared to female controls, whereas both male meditators and male controls showed equivalent increases. Moreover, only females showed increases in self-compassion associated with improved affect. Overall, these findings indicate the efficacy of classroom-based mindfulness interventions and interventions that take into account the different developmental needs of female and male individuals.

Discussion

For this review, we assessed ten studies (indexed in Scopus, Web of Science Core Collection, and PubMed) on school students who received school-based yoga programs and school-based mindfulness training as an intervention. Among these studies, there were four RCTs, five single group studies, a qualitative research, and an exploratory examination. The studies reviewed suggest that school-based MBIs are successful in helping students cope with several personal and schooling difficulties. These studies mostly focused on the effects of school-based MBIs on students' (1) behavior and stress management, (2) positive affect and well-being, (3) cigarette smoking and substance use, and (4) cognitive functioning and academic performance. The majority of these studies involved school-based yoga interventions such as the KYIS curriculum, Y.O.G.A. for youth, Y4C, mindful yoga, and TLS. The remaining studies involved school-based interventions using MBSR and mindfulness meditation techniques. These interventions were found to have beneficial effects on

students' relaxation, positive thinking, cognitive restructuring in response to stress, affect, resilience, mood, and emotion-regulation.

Clearly, this review has limitations. First, the included studies were broad and did not allow us to make any definitive statements. Second, our conclusions are only as good as the data and studies that we identified. Moreover, alongside results suggesting several significant beneficial effects, some of these studies found no effects on measures of self-control, involuntary engagement coping, somatization, or general affect; in a study, neither suspensions nor academic grades were affected by the intervention. A possible explanation for these findings is that the interventions had not been tailored to the developmental stage of the children receiving the programs (Šouláková et al. 2019). Furthermore, some of the studies were limited by factors such as the small number of subjects and the use of assessment tools, the validity and reliability of which were not recognized. Other limitations included the short duration of the intervention programs and a lack of active control groups.

The practical implications of these findings include considerations related to the incorporation of MBIs in school curricula. Across reviewed studies, we found some support for MBIs as part of school curricula to reduce negative effects of stress and promote overall well-being with caveats to consider in choosing specific programs. In fact, whereas mindfulness training had significant impact on students' cognitive performance, attentional capacities, and emotional well-being, school-based yoga programs were found to be effective in improving students' mental health and well-being, and decreasing their willingness to engage in unhealthy behaviors, such as smoking cigarettes or drinking alcohol. Moreover, these interventions may be used as preventive programs, which are especially suited to school settings where children spend most of the time, most of the year, during the developmentally important years of childhood and adolescence.

Conclusions

Notwithstanding the heterogeneity in terms of procedures, age range, and sample size, the studies reviewed seem to suggest some beneficial effects of school-based yoga and mindfulness programs. Although additional research is needed especially regarding the long-term effects of mind-body interventions in school settings, if schools incorporated these practices in their curricula, students would likely benefit from them.

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Compliance with Ethical Standards

Conflict of Interest The authors declare they have no conflict of interest.

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