



Effectiveness of School-Based Psycho-Educational Interventions in Preventing Sub-clinical Anxiety and Stress in Adolescents

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Abstract

Adolescence represents a crucial period of development, during which exposure to stress can significantly impact mental and physical health. As such, school based psychoeducational interventions aimed at reducing stress may hold promise for promoting adolescents' wellbeing. In the current study, a literature review was conducted using PubMed and PsychInfo databases to evaluate school-based psychoeducational interventions that target sub-clinical anxiety and stress in healthy adolescents. Eleven studies met the inclusion criteria, comprising six primary and five secondary studies. Cognitive-behavioural therapy demonstrated significant reductions in anxiety symptoms and improvements in emotional regulation. Mindfulness-based interventions alleviated physiological stress, while physical activity programs such as yoga, showed potential in improving psychological well-being, albeit with limited evidence. Findings on the duration of interventions were mixed, with some meta-analyses indicating larger effects for longer or higher intensity programs, while limited evidence suggests caregiver involvement may enhance outcomes. Future research should focus on evaluating the long-term effectiveness of these interventions and examining their applicability across diverse cultural and socioeconomic contexts. Although harms were not identified within the studies

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included in this review, other research has reported potential unintended effects of school-based psychological interventions in specific subgroups and therefore cautious implementation with routine monitoring is recommended.

Plain Language Summary

Many teenagers experience stress and anxiety that do not always meet clinical levels but can still affect their daily lives and long-term health. Researchers conducted a review of studies examining school-based psychoeducational programs aimed at reducing these issues in adolescents. They focused on various strategies, including cognitive-behavioral therapy (CBT), mindfulness-based interventions (MBI), and physical activities such as yoga. The studies showed that school-based psychoeducational programs, when offered in school settings, reduced mild anxiety symptoms and encouraged better emotional control. Students who participated in mindfulness approaches reported feeling calmer, developed healthier coping habits, and sometimes showed reduced physiological signs of stress. Although physical activities like yoga appeared to help students feel better about themselves, further research is needed to confirm these benefits. The effectiveness of these interventions did not depend on how long they lasted. Rather, studies indicated that support from parents, combined with the program's techniques, improved the overall success of each approach. In some cases, when parents and caregivers joined the activities or received guidance on how to assist their teenagers at home, students displayed stronger results. Schools serve as important places for these programs because they reach many adolescents in familiar environments. According to the review, introducing psychoeducational interventions in schools is a promising way to decrease mild anxiety and stress in teenagers, while potentially preventing more serious problems that can appear during adulthood. More investigations are needed on how these methods hold up over time and how they can be applied in different cultural and economic settings. Overall, school-based interventions that involve CBT, mindfulness practices, or physical activities can help prevent and manage sub-clinical anxiety and stress in teenagers. Adding family.

Keywords

stress, sub-clinical anxiety, psychoeducation, school-based intervention, management

Introduction

Adolescence is the transitional phase of growth and development between childhood and adulthood, characterized by significant changes in biological, psychosocial dynamics, cognition and emotions ([National Academies of Sciences, Engineering, and Medicine et al., 2019](#); [Sawyer et al., 2018](#)). This period offers a window of opportunity for developing social, physical and emotional coping strategies, which are crucial for mental health. In addition, during this period, adolescents form their personalities and acquire essential skills to manage future stressful situations ([Sawyer et al., 2018](#); [World Health Organization, 2021](#)). A supportive environment provided by family, school, and the community is essential for enhancing well-being and enabling individuals to confront modern societal challenges ([World Health Organization, 2021](#)).

The World Health Organisation defines stress as a state of worry or mental tension caused by challenging situations ([World Health Organization, 2023](#)). It is a physiological or psychological response to internal or external stressors that urge individuals to address and confront challenges during their life ([APA, 2022](#)). While a certain degree of stress is normal and necessary for daily

functioning, excessive stress has a significant negative impact on core physiological systems. It considerably affects brain function, including memory, cognition and learning, and compromises the cardiovascular, endocrine and gastrointestinal systems (Yaribeygi et al., 2017). Increased stress manifests through a variety of physical symptoms including headaches, stomach aches, or limiting wellness and affecting quality of life. Chronic stress constitutes a major risk factor for diseases affecting the cardiovascular system, cancer and mental health disorders and leads to immunosuppression (Dhabhar, 2014).

The terms ‘stress’ and ‘anxiety’ are often used interchangeably, though they refer to distinct phenomena. According to the American Psychological Association (APA, 2022), both are emotional reactions, but stress is usually triggered by an external factor which can be short-term or long-term. Adolescents experiencing stress may exhibit mental and physical symptoms, including irritability, anger, fatigue, muscle pain, digestive issues, and sleep disturbances. Conversely, anxiety involves persistent, excessive worry without an external factor, with symptoms similar to stress including insomnia, difficulty concentrating, fatigue, muscle tension, and irritability. Mild forms of both conditions can be managed with coping strategies but may escalate into chronic stress and anxiety disorders if not managed in time (APA, 2022; Putwain, 2007;). In addition to clinically diagnosed, sub-clinical anxiety exists characterised by an individual experiencing worry for a duration of at least three months, accompanied by symptoms such as restlessness, fatigue, concentration difficulties, irritability, muscle tension, and sleep disturbances (Volz et al., 2021).

Globally one in seven adolescents, (ages 10 to 19) experiences a mental health condition (Global Burden of Disease Child and Adolescent Health Collaboration, 2017; World Health Organization, 2021). It is estimated that 3.6% of adolescents aged 10–14 and 4.6% aged 15–19 experience anxiety disorders (Global Burden of Disease Child and Adolescent Health Collaboration, 2017; World Health Organization, 2021). For adolescents, stress is associated with lower productivity and poorer academic performance (Obermeier et al., 2023) and increases the risk of developing disorders including depression, anxiety, substance use and cardio-metabolic disorders in adulthood (Lee et al., 2021).

Diagnosing stress and anxiety in adolescents is challenging, as these emotions may be confused with typical fears and worries, leading to underdiagnosis and untreated cases (Baourda et al., 2021). Considering the plasticity of adolescence and its importance in human development as well as the importance of coping mechanisms to regulate stress and anxiety during this period and later in adulthood, interventions aimed at promoting mental wellbeing by reducing stress and anxiety are of utmost importance. Research so far indicates that interventions need to focus on enhancing emotional regulation, building resilience for managing challenging situations and adversities, and promoting supportive social environments (World Health Organization, 2021). Documented interventions include cognitive behavioural therapy (CBT), mindfulness practices, family-based programs and social skills training, all aimed at promoting the mental wellbeing of adolescents while mitigating the long-term effects of chronic stress and anxiety (Clarke et al., 2021).

One major category is psychoeducational interventions which are structured approaches that aim to educate individuals about psychological issues, enhancing understanding and coping strategies through information and skills training (Suzuki & Tanoue, 2020). The goal is to empower individuals to manage their mental health, reduce symptoms, and tackle challenges (Lukens & McFarlane, 2004; Morgado et al., 2021; Ramaiya et al., 2022; Wolgensinger, 2015). In schools, psychoeducational interventions could potentially be effective, as they integrate into daily adolescent life and leverage the supportive environment of the educational system (World Health Organization, 2021).

Psychoeducational interventions can draw on various disciplines, such as education, psychotherapy (e.g. Cognitive Behavioral Therapy (CBT), Dialectical Behavioral Therapy (DBT), rational

emotive behavioral therapy (REBT)) mindfulness-based interventions (MBI) (e.g. meditation and breathing exercises), cognitive psychology (e.g. self-efficacy or the confidence in one's ability to carry out a behaviour), positive psychology (e.g. gratitude), physical education (e.g. exercise regimes), nutrition (e.g. healthy eating), sociology and social psychology (e.g. peer and parental guidance) (Morgado et al., 2021; Ramaiya et al., 2022; Wolgensinger, 2015).

CBT is a structured, goal-oriented psychotherapy that targets maladaptive thoughts and behaviours using techniques such as exposure, behavioural activation, and cognitive restructuring. DBT is a cognitive behavioural treatment grounded in the biosocial theory of emotion dysregulation. It combines change strategies with acceptance-based strategies within a dialectical framework and is delivered through coordinated modes, individual therapy, group skills training, between-session coaching, and a therapist consultation team. Core skills include mindfulness, distress tolerance, emotion regulation, and interpersonal effectiveness, with adolescent adaptations that incorporate caregiver participation and "walking the middle path" skills (Ramaiya et al., 2022; Wolgensinger, 2015). These psychotherapeutic interventions and other methods including exercise and school-based psychoeducation aim to enhance adolescent mental well-being (Morgado et al., 2021). By combining psychoeducation with psychotherapeutic techniques, schools can offer interventions that aim to promote a holistic approach to social, physical and mental well-being of adolescents (Morgado et al., 2021).

The aim of this narrative review is to present the latest evidence on school-based psychoeducational interventions, focusing on the effectiveness of empowering adolescents with coping skills for 'sub-clinical anxiety' and 'stress' across various geographical locations and school environments.

Methods

A search was conducted in PubMed and PsychInfo databases to retrieve primary and secondary studies investigating school-based psychoeducational interventions implemented to empower adolescents with coping skills to deal with 'sub-clinical anxiety' and 'stress' in different geographical locations and school environments.

The Inclusion criteria were as follows.

- Studies discussing school-based psychoeducational interventions in healthy (without any non-communicable or chronic conditions such as type I diabetes, asthma or mental health disorders) adolescents, aged 12-18 years, irrespective of sex or gender, and from any geographical or ethnic background.
- Outcomes included sub-clinical anxiety and/or stress. Studies with no evidence on whether anxiety was at sub-clinical level at baseline were excluded.
- Both primary (quasi experimental, non-randomised trials and randomised controlled trials) and secondary (systematic reviews and meta-analyses) studies were eligible, irrespective of overlap.
- Only articles written in the English language, published between 2014 to April 2024, and with full text available, were included.

The Search strategy in the two databases is provided in [Supplemental Table 1](#).

Results

Six primary studies met the inclusion criteria (two were quasi-experimental studies, one was a non-randomized controlled trial, and the three remaining were randomized controlled trials). Five studies were secondary studies (1 systematic review and 4 meta-analyses).

Primary Studies

All the primary studies are provided in [Table 1](#).

Quasi Experimental Studies. Two studies utilised a pretest-post-test quasi experimental design ([Bluth et al., 2015](#); [Roy et al., 2016](#)) ([Table 1](#)).

[Bluth et al. \(2015\)](#) conducted a pilot study in the U.S. with 28 adolescents to assess the effects of a mindfulness-based intervention (MBI) on emotional well-being. Participants attended six weekly 90-min sessions using the “Learning to Breathe” curriculum. Outcomes measured included perceived stress, mindfulness, life satisfaction, and self-compassion. While self-compassion significantly improved, decreases in perceived stress (from 28.32 to 25.39, Hedge’s $g = 0.34$) were not statistically significant. Notably, self-compassion and life satisfaction showed inverse correlations with perceived stress, suggesting that improvements in these areas may reduce stress. The study highlights the potential of mindfulness to enhance emotional well-being, but larger studies are needed to confirm these findings.

The pre-post study by [Roy et al. \(2016\)](#) assessed the impact of life skills training on reducing stress among adolescents in India. The study involved 42 boys from the 9th and 10th grades, participating in a structured seven-day program. Each session lasted 45-60 minutes and aimed at enhancing stress management and coping skills following the National Institute of Mental Health and Neurosciences (NIMHANS) model. Stress levels were measured using the Manipal Stress Questionnaire before, immediately after, and one and three months following the intervention. Statistical analysis demonstrated a significant reduction in mean stress levels between baseline and one- and three-months follow-up ($p < 0.05$). The program was considered feasible and was well-received by participants. The authors proposed that group-based stress management programs may be beneficial in reducing stress levels among adolescents.

Non-Randomized Trials (nRCT). [McMahon et al. \(2021\)](#) investigated the effects of Kundalini Yoga on emotional dysregulation and psychological functioning in U.S. adolescents. The study involved a six-week program with twice-weekly sessions, focusing on postures, breathing, and meditation. Participants included students from four schools, with the control group engaging in alternative extracurricular activities. Psychological outcomes were assessed using the Depression, Anxiety, and Stress Scale (DASS-21) and the Profile of Mood States for Adolescents (POMS-A). While no significant changes in depression, anxiety, or stress were found on the DASS-21, reductions in emotional dysregulation, anger, and fatigue were observed on the POMS-A. Effects varied significantly across schools; in one school, intervention participants showed notable improvements in anxiety, stress, and depression, while another school reported increased anxiety levels in the intervention group. These variations were attributed to differences in program implementation and environmental factors, emphasizing the importance of contextual influences on the effectiveness of Kundalini Yoga for stress and emotional regulation.

Table 1. Descriptive Characteristics of Primary Studies (Quasi Experimental, Non-randomized Controlled Trials and Randomized Controlled Trials) Investigating the Role of Psychoeducational Interventions on Sub-clinical Anxiety and Stress in Adolescents

Study	Aim	Type of study	Country	Participants	Methods	Key findings
Quasi experimental studies						
A pilot study of a mindfulness intervention for adolescents and the potential role of self-compassion in reducing stress (Bluth et al. (2015))	To investigate the effects of a mindfulness intervention on emotional well-being outcomes in adolescents and to examine the relationship between mindfulness, self-compassion and stress reduction	Pre-post pilot intervention study	United States	Number of participants: 28 adolescents Age: 10-18 years	Type of intervention: Mindfulness-based stress reduction intervention Intervention group: 28 adolescents • Frequency: 1 session/week • Duration: 1.5 h • Structure: 6 sessions of "learning to BREATHE: A mindfulness curriculum for adolescents". An intervention which was based on mindfulness-based stress reduction adapted for adolescents Control group: N/A Assessment • Method of assessment: Online questionnaires at pre-pilot and post-pilot • Questionnaires used: CAMM, PSS, SLS, SCS • Outcomes assessed: Mindfulness, perceived stress, and life satisfaction, self-compassion	<ul style="list-style-type: none"> • CAMM: Increased from a mean of 33.11 (SD = 6.62) to 34.61 (SD = 5.15), with a small effect size (Hedges $g = 0.24$), $p = n.s$ • PSS: Decreased from a mean of 28.32 (SD = 7.57) to 25.39 (SD = 9.23), with a small effect size (Hedges $g = 0.34$), $p = n.s$ • SLS: Increased from a mean of 2.63 (SD = 0.60) to 2.84 (SD = 0.61), with a small effect size. (Hedges $g = 0.33$), $p < 0.10$ • SCS: Increased from a mean of 2.85 (SD = 0.73) to 3.16 (SD = 0.80), with a small to moderate effect size (Hedges $g = 0.40$), $p < 0.05$ • Improvements in self-compassion were linked with reductions in perceived stress ($r = -0.55$, $p = 0.002$) • Improvement in mindfulness was linked with reductions in perceived stress ($r = -0.59$, $p = 0.001$) • Main conclusion: Mindfulness may effectively improve emotional well-being with self-compassion providing a potential pathway to reducing stress

(continued)

Table 1. (continued)

Study	Aim	Country	Participants	Methods	Key findings
Effectiveness of life skill training program on stress among adolescents at a school setting Roy et al. (2016)	To assess the effectiveness of a life skill training program in reducing stress among adolescents	India	Number of participants: 42 adolescents (boys) Age: Studying in 9th and 10th grades	Type of intervention Life skills and stress management modules from the NIMHANS model Intervention group: 42 adolescents Structure: Seven daily sessions of 45-60 minutes each, within school timings Control group: N/A Assessment <ul style="list-style-type: none"> • Method of assessment: Pre, post, and one & three-month follow-up assessments • Questionnaires used: YSQ • Outcomes assessed: Stress level 	<ul style="list-style-type: none"> • 66% of the adolescents reported being stressed at baseline • Mean stress scores significantly reduced from 133 (baseline) to 116 (after one month) and to 117 (after three months) ($p < 0.05$) • Intervention was found to be feasible and acceptable, with 90% of participants finding the sessions "very helpful." • Role plays on "peer pressure" were liked by all participants, and 84% recommended regular continuation of such programs • The study highlighted the importance of group-based stress management programs in reducing stress levels among adolescents • Main conclusion: Group-based stress management programs may be beneficial in reducing stress levels among adolescents

(continued)

Table 1. (continued)

Study	Aim	Country	Participants	Methods	Key findings
Non-randomized controlled trials A non-randomized trial of kundalini yoga for emotion regulation within an after-school program for adolescents McMahon et al. (2021)	To examine the effects of the kundalini yoga-based Y.O.G.A. for youth, in the context of an after-school program on adolescents with self-reported emotional dysregulation and psychological functioning	USA	Number of participants: 118 Age: 11-14 years	Type of intervention • Kundalini yoga-based Y.O.G.A. for youth. Students chose their after-school activity and those that preferred yoga for youth were assigned as the intervention group. Students in the other activities groups were assigned as the control group Intervention group: N = 52 Intervention • After-school program for adolescents with self-reported emotion dysregulation and psychological functioning • Program included: Opening mantra, breath practice, physical warm up, kriya, physical postures, meditation, relaxation, closing song • Frequency: 2 sessions/week for 6 weeks • Duration of session: 40 min Control group: N = 66 outdoor play, free time, tutoring Assessment • Methods of assessment: Completion of self-reports before intervention and after 6 weeks • Questionnaires used: Depression, anxiety and stress scale-21 items (normal score for anxiety: 0-7, participants score: 4-5, normal score for depression: 0-9, normal score for stress: 0-14), POMS-a, DERS-SF Outcome measures: Emotion dysregulation, anxiety, depression, stress and mindfulness	<ul style="list-style-type: none"> Students in the yoga program at school a showed significant reductions in anxiety ($p = 0.001$), stress ($p < 0.001$), and depression ($p < 0.001$) compared to the control group Significant decrease in emotional dysregulation ($p = 0.021$) No significant changes were observed within schools B, C and D, $p > 0.05$ Students in the yoga program in school C showed higher anxiety than their comparison group, $p = 0.036$ Main conclusion: The effectiveness of kundalini yoga in reducing stress and emotional dysregulation may depend on school settings, highlighting the role of contextual factors in influencing program outcomes
Randomized controlled trials					

(continued)

Table 1. (continued)

Study	Aim	Type of study	Country	Participants	Methods	Key findings
Predictors of school-based cognitive behavior therapy outcome for youth with anxiety Wergeland et al. (2023)	To examine the effectiveness of indicated school-based CBT and to compare the effectiveness of two CBT interventions of different intensity in youth with anxiety	Randomized-controlled trial	Norway	Number of participants: 302 Age: 12–16 years	Study design • CBT • Students included if they self-reported or their parents reported youth anxiety symptoms > or = 25 on the Spence Children's Anxiety Scale. Groups of five to eight students were recruited and assigned randomly at each school to brief CBT (n = 142) or standard CBT (n = 160) or to waitlist (n = 104) Intervention: A. Brief intervention • Duration: 45-90 minutes • Frequency: The first four meetings were delivered weekly, and the final session was delivered five weeks after session four • Structure: Five-session manualized CBT program. Self-help material was provided to students and practice exposure on their own was encouraged. Both youth and parents participated in 2 sessions (60-min each), where helpful parenting strategies with anxious youth were discussed. Parents received written material focusing on parental support for youth anxiety. B. Standard CBT intervention • Duration: 90 minutes • Frequency: 1 session/week • Structure: 10-session manualized CBT program, workbooks with session summaries, worksheets and guides for home practice were given to participants and parents. Parents participated in 2 sessions (90 minutes each), where they were informed about the content of the program, and parental support for youth anxiety was addressed. C. Waiting list group: did not receive any kind of intervention until the end of the study. After the post-assessment, youth were randomized to receive one of the two interventions Assessment • Method of assessment: Outcomes were based on youth-, and parent-reported, youth anxiety and depressive symptoms at post-intervention and 1-year follow-up • Questionnaires used: Spence Children's Anxiety Scale, Child Anxiety Life Interference Scale, DASS-21, clinical global impression scale Outcome measures: Anxiety symptoms, severity and impairment, and goals of youths with regards to their anxiety	<ul style="list-style-type: none"> • Significant increase in anxiety symptom improvement at post-intervention [1.84 (SD 14.57) and from post-intervention to 1-year follow-up: [-2.78 (SD 11.70)] • Higher parent-reported credibility and expectancy was associated with larger pre-to post-intervention youth-reported anxiety symptom improvement ($\beta = -0.44$; $p = 0.001$) • Higher caregiver strain was associated with less symptom improvement at post-intervention • No significant predictors at 1-year follow-up • Main conclusion: Parental expectations and credibility are important for optimizing outcomes in school-based CBT, while families with high caregiver strain may require additional support. No difference between brief and longer duration interventions

(continued)

Table 1. (continued)

Study	Aim	Type of study	Country	Participants	Methods	Key findings
Reducing psychological stress of Chinese adolescents by mindfulness-based intervention: The mediating role of resilience Liu et al. (2023)	To address the effectiveness of mindfulness based interventions in reducing psychological stress in Chinese school setting and the mediating role of resilience between trait mindfulness and psychological stress	Cluster randomized control trial	China	Number of participants: 189 Age: 13-17 years	Study design • Four classes out of twelve were randomly assigned to the experimental group (n = 92 students) and two to the control group (n = 97 students) Intervention: MBI • Duration: 45 minutes • Frequency: 1 session/week • Structure: 10 lessons of mindfulness-based intervention, everyday mindfulness practices of 10-15 min delivered by the instructors, participants were encouraged to practice daily by themselves Control group: Regular school program only Assessment • Method of assessment: Students completed questionnaires at baseline and post-intervention. Questionnaires used: Psycho-somatic-tension-relaxation inventory, five facet mindfulness questionnaire, resilience scale for Chinese adolescents Outcome measures: Psychological stress, trait mindfulness, and psychological resilience	<ul style="list-style-type: none"> Psychological stress: Post-test scores in the experimental group were significantly lower than pre-test scores and control group scores. $F = 18.97, p < 0.01$; effect size Cohen's $d = -1.06$ (95% CI: -1.38 to -0.75) Psychological resilience: Post-test scores in the experimental group were significantly higher than pre-test scores and control group scores. $F = 14.30, p < 0.01$; effect size Cohen's $d = 0.90$ (95% CI: $0.59 - 1.21$) Trait mindfulness: Increase in scores: Post-test scores in the experimental group were significantly higher than pre-test scores and control group scores. $F = 42.05, p < 0.01$; effect size Cohen's $d = 1.35$ (95% CI: $1.03 - 1.68$) Main conclusion: Mindfulness-based interventions may be effective in reducing psychological stress in adolescents by improving psychological resilience

(continued)

Table 1. (continued)

Study	Aim	Country	Participants	Methods	Key findings
Teaching adolescents about stress using a universal school-based psychoeducation program: A cluster randomised controlled trial Vogelaar et al. (2024)	The study aimed to evaluate the effect of a brief school-based universal psychoeducation program, called the "stress lessons," on adolescents' knowledge about stress and their experienced stress levels	Netherlands	Participants: 1,613 Age: 11-17 years	Study design School classes were randomly and equally allocated to an experimental or to a control group Pre-test and post-test design Intervention <ul style="list-style-type: none"> Intervention group: 765 participants, 63 classes Control group: 878 participants, 63 classes <ul style="list-style-type: none"> Type of intervention: Sessions of psychoeducation ("stress lessons") Frequency: 1 session/week for 3 weeks Duration: 45 minutes Structure: Students were educated about stress, played games that evoked stress, exercised their coping behaviors and stress reactions, exposed to breathing exercises, muscle relaxation exercises and positive thinking. Multiple learning activities were utilized such as listening, independent work, active input, and practical tasks Control group: did not receive lessons regarding stress between pre-test and post-test period. Students received the intervention after post-test assessment <ul style="list-style-type: none"> Method of assessment: Questionnaires were filled out on a computer at pretest and posttest. Each student had his own desk and was given 45 minutes to complete it Questionnaires used: Stress knowledge questionnaire, Dutch version of the adolescent stress questionnaire Measures assessed: Knowledge about stress, overall and school-related stress	<ul style="list-style-type: none"> No changes in the experimental group in overall stress ($t(1382) = 0.96, p = 0.34$), school-related stress ($t(1385) = 1.50, p = 0.13$) from pre- to post-test (overall stress: $M = 2.10$, school-related stress: $M = 2.39$) to post-test (overall stress: $M = 2.13$, school-related stress: $M = 2.46$) Control condition reported reduced overall stress ($t(1599) = -2.92, p = 0.004$) and lower school-related stress ($t(1599) = -2.48, p = 0.01$) from pre- to post-test (overall stress: $M = 2.06$, school-related stress: $M = 2.31$) to post-test (overall stress: $M = 2.21$) Experimental condition had a higher knowledge score at post- ($M = 0.29$) versus pre-test ($M = -0.05$); $t(1387) = 7.78, p < .001$. No change in the control condition from pre- ($M = -0.07$) to post-test ($M = -0.14$); $t(1599) = -1.85, p = 0.06$ Main conclusion: The intervention increased adolescents' knowledge about stress, especially among girls and academic track students. There was no reduction in the overall or school-related stress levels

CAMI: children and adolescent mindfulness measure; MSQ: manual stress questionnaire; NIMHANS: national institute of mental health and neuro sciences; N/A: not available; PSS: perceived stress scale; SCS: self-compassion scale-short form; SD: standard deviation; SLSS: student life satisfaction scale; DERS-SF: difficulties in emotion regulation scale-short form; Y.O.G.A.: your own greatness affirmed; POMS-A: profile of mood states-adolescents; CBT: cognitive behavioral therapy; CI: confidence interval; DASS-21: depression anxiety stress scale; DBT: dialectical behavioral therapy; MBI: mindfulness-based intervention; SD: standard deviation.

Randomized Control Trials (RCTs). Our search identified 3 randomized controlled trials (RCTs) (Liu et al., 2023; Vogelaar et al., 2024; Wergeland et al., 2023) (Table 1).

Wergeland et al. (2023) conducted a randomized waitlist-controlled trial of 320 youths in Norway who were engaged in either a 10-session or a 5-session CBT group intervention. The study aimed to identify the factors, such as youth and parental characteristics, that predict the benefits of such intervention for youth subclinical anxiety. The outcomes were measured by changes in self-reported anxiety and depression symptoms at post-intervention and at one-year follow-up. Anxiety was measured by various measurements including the Spence Children's Anxiety Scale, the Child Anxiety Life Interference Scale and the DASS-21 scale which indicated subclinical anxiety. In addition, the study excluded adolescents who received other mental health services. The findings highlighted the role of parental perceptions and attitudes as predictors of the effectiveness of the intervention. Specifically, higher parent-reported credibility and expectancy of the intervention was associated with larger youth-reported anxiety symptom improvement ($\beta = -0.46, p = 0.003$). Parent-reported youth impairment from anxiety showed improvement ($\beta = -0.76, p < 0.001$) and higher parent-reported credibility and expectancy resulted in larger symptom improvements ($\beta = -0.44, p = 0.001$). The significant changes were notable at post-intervention, but no improvement was found at 1-year follow-up.

Liu et al. (2023) conducted a clustered RCT in China to assess the effectiveness of mindfulness-based interventions (MBIs) in reducing psychological stress and enhancing resilience among adolescents. The study involved 92 students in the intervention group, who attended 10 weekly 45-min mindfulness sessions led by trained instructors, and 97 control students following the standard school program. Psychological stress, trait mindfulness, and resilience were measured using validated questionnaires. The results showed significant reductions in stress levels (pre-test mean: 1.76; post-test mean: 1.30, $p < 0.05$) and improvements in psychological resilience within the intervention group. A significant interaction effect between the intervention and control groups was observed, with a large effect size (Cohen's $d = 1.04$, 95% CI: 0.72–1.35). These findings suggest that MBIs may effectively reduce stress in adolescents by strengthening psychological resilience.

In a clustered RCT conducted by Vogelaar et al. (2024), the researchers evaluated the effectiveness of a psychoeducational program called "Stress Lessons" on 1613 adolescents in the Netherlands. The intervention consisted of 3 lessons, delivered once per week for 45 minutes and aimed to reduce overall and school stress and increase knowledge about stress. The control group did not receive the lessons during the intervention. To assess the intervention's impact, the study employed the Stress Knowledge Questionnaire and the short Dutch version of the Adolescent Stress Questionnaire at both pre- and post-intervention stages. The results for the experimental group showed a significant increase in stress knowledge, with a mean difference of 0.41 and an effect size (d) of 0.35, indicating small to medium effects ($p < 0.001$). However, no significant changes were observed in the overall and school-related stress in the experimental group ($p = 0.34$ and $p = 0.13$ respectively). Interestingly, the control group reported a decrease in the overall and school-related stress ($p = 0.004$ and $p = 0.01$ respectively). These findings suggest that while the "Stress Lessons" program successfully increased stress knowledge, it did not effectively reduce stress levels, contrasting with the control group outcomes.

Secondary Studies

Our search identified one systematic review (Jagiello et al., 2024) and 4 meta-analyses (Fulambarkar et al., 2023; Ng et al., 2024; Van Loon et al., 2020, 2022). All the secondary studies are provided in Table 2.

Table 2. Systematic Reviews and Meta-Analyses Investigating the Role of Psychoeducational Interventions on Sub-clinical Anxiety and Stress in Adolescents

Study	Aim	Type of study	Country	Studies and participants	Methods	Key findings
Systematic review						
Academic stress interventions in high schools: A systematic literature review Jagello et al. (2024)	To assess the effectiveness of high-school-based programs in decreasing or preventing academic stress and understand the delivery characteristics that may alter program effectiveness	Systematic review	Studies from 13 countries: USA, United Kingdom, Australia, Canada, Netherlands, China, Switzerland, Finland, India, Israel, Jordan, Kenya, and Romania	Number of studies: 31 (from 1970 to 2022) Number of participants: 161,62 Age of participants: 12-19 years	Databases: PsycINFO and ERIC. Inclusion criteria <ul style="list-style-type: none"> Participants were high school students The intervention was school based 	<ul style="list-style-type: none"> CBT showed the strongest evidence for effectiveness Universal and targeted approaches can both be beneficial though universal programs showed more mixed effectiveness Most interventions were delivered by psychologists, and these were generally more effective, particularly CBT programs Statistical outcomes often included effect sizes and levels of significance, with many studies showing significant reductions in stress or anxiety Main conclusion: CBT-based programs were generally effective in reducing academic stress. However, there's a need for more high-quality studies, specifically randomized controlled trials with active control groups, larger samples, and long-term follow-ups. Future research should focus on implementation success, particularly for programs delivered by school staff
					<ul style="list-style-type: none"> The primary aim of the intervention was to reduce or prevent school-related stress or anxiety A primary outcome measure was students' level of stress or anxiety, measured at pre- and post-intervention RCT study design 	
					<ul style="list-style-type: none"> Exclusion criteria Subgroup analyses were not reported for high school students 	
					<ul style="list-style-type: none"> The intervention aimed primarily at reducing non-academic stress or other disorders (e.g., PTSD, social anxiety disorder) Review or research protocol study designs, without original data 	
					Type of interventions	
					<ul style="list-style-type: none"> CBT, including traditional CBT, acceptance and commitment therapy, and stress inoculation training Cognitive bias modification Systematic desensitization Mindfulness and meditation, including yoga Social emotional learning Expressive writing Relaxation techniques such as progressive muscle relaxation 	
					Assessment	
					<ul style="list-style-type: none"> The assessment primarily involved self-report questionnaires to measure changes in academic stress and anxiety levels pre- and post-intervention 	
					Questionnaires	
					<ul style="list-style-type: none"> State-trait anxiety inventory: Used in six studies Spielberger test anxiety inventory: Used in five studies or a variation thereof Revised test anxiety scale and test anxiety scale for children: Each used in four studies Adolescent stress questionnaire, Friedlender test anxiety scale, revised Children's anxiety and depression scale, symptoms of stress inventory, and the 7-item anxiety scale: Used in two or three studies each 	

(continued)

Table 2. (continued)

Study	Aim	Type of study	Country	Studies and participants	Methods	Key findings
<p>Meta-analysis</p> <p>Can schools reduce adolescent psychological stress? A multilevel meta-analysis of the effectiveness of school-based intervention programs</p> <p>van Loon et al. (2020)</p>	<p>To evaluate the effectiveness of school-based intervention programs in reducing adolescent psychological stress and to investigate moderators of effectiveness</p>	<p>Multilevel meta-analysis</p>	<p>Various countries</p>	<p>Number of studies: 54 (from 1988 to 2019)</p> <p>Number of participants: 16,475</p> <p>Age of participants: 10 to 18 years</p>	<p>Databases</p> <p>CINAHL, PubMed, ERIC, PsycINFO, and CENTRAL.</p> <p>Inclusion criteria</p> <p>School-based psychosocial intervention programs targeting stress</p> <p>Participants aged 10–18 years</p> <p>Included pre- and post-intervention assessments</p> <p>Written in English</p> <p>Exclusion criteria</p> <p>Not meeting the inclusion criteria</p> <p>Types of interventions</p> <ul style="list-style-type: none"> ms targeting stress reduction, including mindfulness, relaxation exercises, and cognitive-behavioural techniques <p>Assessment and questionnaires used</p> <ul style="list-style-type: none"> Self-report questionnaires measuring psychological stress Perceived stress scale Depression anxiety stress scales Adolescent stress questionnaire Body barometer Stress appraisal measure for adolescents Adolescent stress and coping measure Maastricht university stress instrument for children Behavior assessment system for children and adolescents Symptoms of stress inventory General stress scale Education stress scale for adolescents Scale for academic stress Subjective stress scale 	<p>Effectiveness</p> <ul style="list-style-type: none"> School-based intervention programs generally have a moderate positive effect (Cohen's $d = 0.543$, $p < .001$) on reducing adolescent psychological stress Moderating factors: Factors like participant selection method, the specific type of stress targeted, and timing of assessments influence program effectiveness. More specifically Effectiveness in selected samples: Significant stress reduction seen primarily in selected student samples, such as those who self-select or are identified through screening for high stress Type of stress: Programs are more effective in reducing school-related stress compared to social stress Long-term impact: Effects of interventions are greater at follow-up than immediately post-intervention <p>Main conclusion</p> <ul style="list-style-type: none"> School-based intervention programs are effective in reducing psychological stress in adolescents, particularly when tailored to those with higher initial stress levels or specific vulnerabilities, and they are more beneficial when they target school-related stress

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Table 2. (continued)

Study	Aim	Type of study	Country	Studies and participants	Methods	Key findings
van Loon et al. (2022)	To evaluate the effectiveness of school-based intervention programs on psychological stress indicators such as cortisol, blood pressure (BP), and heart rate (HR)/heart rate variability (HRV), in adolescents, and to examine moderators of effectiveness	Meta-analysis	Various countries	Number of studies: 30 (from 1987 to 2019)	Databases: CINAHL, PubMed, ERIC, PsycINFO, and CENTRAL	<ul style="list-style-type: none"> Overall effectiveness on BP: School-based intervention programs showed a significant, though small, positive effect on reducing BP in adolescents (Cohen's $d = 0.173$, $p = 0.14$). This suggests that these interventions can have a beneficial impact on cardiovascular stress indicators in this age group. Heart rate and heart rate variability: No significant overall effect on heart rate or heart rate variability ($d = 0.134$, $p = 0.209$). This could be due to several factors, including possible developmental differences in responsiveness to stress interventions or differing focuses in the intervention components. Cortisol: No quantitative meta-analysis performed due to significant methodological variability across studies. However, a qualitative review revealed inconsistent results. Some studies showed improvement in cortisol levels post-intervention, while others did not. Influential intervention components: Interventions incorporating mindfulness and/or meditation components were found to generally have stronger effects on physiological stress markers. These components seem particularly effective compared to interventions focusing solely on cognitive-behavioural techniques. Type of interventions: Programs that included relaxation exercises contributed to larger reductions in BP. Intensity of interventions: The intensity of the program positively correlated with effectiveness. Interventions with more hours tended to show greater improvements in physiological stress parameters. Lack of effect of yoga components: Unlike expected outcomes from yoga, intervention programs with yoga components did not show significant improvements in BP, contrary to some adult studies suggesting benefits from practices like yoga. This might indicate developmental or methodological differences such as the focus of the yoga practices not emphasizing the most beneficial aspects like breathing. Main conclusion: School-based intervention programs can effectively reduce blood pressure, an indicator of physiological stress, in adolescents. Programs that include mindfulness, meditation, or relaxation components are more effective, particularly those with higher intensity. Incorporating techniques to address physiological stress may help prevent mental health problems in adolescents.
				Number of participants: 4,460	Inclusion criteria	
				Ages: 10 to 18 years	<ul style="list-style-type: none"> School-based interventions promoting psychosocial functioning with at least one physiological stress-related outcome 	
					Exclusion criteria	
					<ul style="list-style-type: none"> Interventions with primary focus on physical health and if only aimed to promote psychosocial functioning by improving physical health through physical activity or exercise 	
					<ul style="list-style-type: none"> Types of interventions 	
					<ul style="list-style-type: none"> Mindfulness, meditation, relaxation exercises, and cognitive-behavioral techniques 	
					Assessment and questionnaires used	
					<ul style="list-style-type: none"> Various physiological measures of stress such as cortisol levels, blood pressure (BP), heart rate, and heart rate variability 	

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Table 2. (continued)

Study	Aim	Type of study	Country	Studies and participants	Methods	Key findings
<p>Review: Meta-analysis on mindfulness-based interventions for adolescents' stress, depression, and anxiety in school settings: a Cautionary tale</p> <p>Fulenbarker et al. (2023)</p>	<p>Evaluate the efficacy of mindfulness-based interventions implemented in the school environment, in decreasing symptoms of stress, depression and anxiety among adolescents</p>	<p>Meta-analysis of randomized controlled trials</p>	<p>United States (palo alto university)</p>	<p>Number of studies: 9 (from 2013 to 2020)</p> <p>5046 individuals</p> <p>Age: 12-18 years</p>	<p>Databases</p> <p>MEDLINE, PsycINFO, PsycARTICLES, PsycEXTRA, PsycTESTS, psychology and behavioral sciences collection, PubMed, and EMBASE.</p> <p>Inclusion criteria</p> <ul style="list-style-type: none"> • Mindfulness-based interventions (MBIs) conducted in school settings, involving adolescents aged 12-18, using quantitative outcomes for stress, depression, or anxiety • Exclusion criteria 	<ul style="list-style-type: none"> • Overall effectiveness: MBIs resulted in a small but significant overall improvement in symptoms of stress, depression, and anxiety across studies (Hedge's $g = 0.33$, $p < 0.01$) • Stress: MBIs significantly reduced stress among adolescents, with a moderate effect size (Hedge's $g = 0.55$, $p < 0.01$). This suggests that MBIs are effective for stress management in school settings • Depression: The interventions showed a small, non-significant effect on reducing depressive symptoms (Hedge's $g = 0.20$, $p < 0.01$), indicating limited impact in this area • Anxiety: No significant effects were observed, reflected by a small, non-significant effect size (Hedge's $g = 0.19$, $p = 0.25$) • Comparison to control groups: MBIs had a small but significant effect compared to inactive control groups (Hedge's $g = 0.38$, $p < 0.05$), but they were not significantly different when compared to active control groups • Main conclusion: MBIs in school settings yield significant improvements in stress among adolescents, but not in depression or anxiety. The interventions showed positive outcomes when compared to inactive controls, indicating potential benefits for stress management in schools but highlighting the need for further research to evaluate the interventions' efficacy for depression and anxiety

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Table 2. (continued)

Study	Aim	Type of study	Country	Studies and participants	Methods	Key findings
Stress management interventions among U.S. high school adolescents: A meta-analysis Ng et al. (2024)	To quantitatively evaluate the outcomes of interventions concerning the management of stress among high school adolescents in the U.S. and identify the moderators of interventions through moderation analysis of the studies included	Meta-analysis	United States	Number of studies: 25, extracted from 24 articles (from 2011 to 2021) Participants: 3,100 Age: 12-20 years	Databases: CINAHL, ERIC, PubMed, PsycInfo Inclusion criteria • RCTs and quasi-experimental design studies • Studies conducted on school or community setting Exclusion criteria • Studies focusing on adolescents with childhood chronic conditions or adolescents experiencing teen pregnancy/parenthood interventions • Days to 15 months • Delivered school-based programs, in juvenile detention centre, or via phone applications • Structure: MBI incorporated mindfulness, grounding, meditation, and/or yoga. CBT promoted resilience, targeted time management, increased physical activity, or promoted the utilization of coping skills. One intervention contained components of both CBT and MBI. • Control groups: N/A Assessment • Method of assessment: N/A • Questionnaires used: 10 and 14-item perceived stress scale, depression anxiety stress scale, burnout stress scale, depression anxiety stress scale, burnout mood scale, trauma symptom checklist for children, strengths and difficulties questionnaire, adolescent stress questionnaire, salivary cortisol secretory immuno- globulin a (sIgA), depression, anxiety and stress scale, spielberger state-trait anxiety inventory, revised child anxiety and depression scale, symptom checklist, generalized anxiety disorder scale, short mood and feelings questionnaire, center for epidemiological studies-depression scale, patient health questionnaire, mental health inventory, positive and negative affect schedule • Measures assessed: Perceived stress, anxiety, depression, positive and negative affect	<ul style="list-style-type: none"> The pooled effects on reducing stress were moderate ($g = -0.36$; $p < .0001$) The interventions had small effects on decreasing anxiety ($g = -0.31$; $p < .0001$) and depression ($g = -0.22$; $p < .0001$) Long-term follow-up effects were -0.77 ($p = 0.019$) on perceived stress, -0.09 ($p = .466$) on anxiety, and -0.19 ($p = 0.05$) on depression MBI and CBT intervention had moderate effect on reducing anxiety ($g = -0.51$) Interventions with longer duration (>8 weeks) were more effective in reducing depression ($g = -0.36$, vs. $g = -0.17$; $p = 0.026$) Non-theory-based interventions were more effective in stress reduction than theory-based interventions ($g = -0.38$ vs. $g = -0.20$; $p = 0.019$) Quasi-experimental studies were more effective than RCTs in reducing perceived stress ($g = -0.40$ vs. $g = -0.16$; $p = 0.001$) Main conclusions: Stress management interventions may be effective in the short term for improving mental health outcomes; yet sustained long-term effects may be evident, suggesting the need for further research to focus on long-term efficacy

BP: blood pressure; CBT: cognitive-behavioural therapy; MBI: mindfulness-based intervention; N/A: not available; PTSD: post-traumatic stress disorder; RCT: randomized controlled trial.

Systematic Review. Jagiello et al. (2024) conducted a systematic literature review to evaluate the effectiveness of high-school-based programs aimed at decreasing or preventing stress related to academic performance among high school students. The review encompassed 31 studies across 13 countries. The intervention programs were categorized based on type (e.g. Expressive Writing, Mindfulness and Meditation), format (universal or targeted) and delivery method (e.g. face-to-face, phone app). Their findings highlighted that CBT approaches were particularly effective with 13 out of 17 studies reporting a significant reduction in academic stress and anxiety among participants. Both targeted programs aimed at students experiencing elevated symptoms of subclinical anxiety or stress and universal programs aimed at students with varying stress levels were found to be beneficial. However, the review also noted several methodological limitations in the studies, including small sample sizes and the use of inactive control groups. These limitations suggest the need for more rigorous research to fully understand the effectiveness of these interventions.

Meta-Analyses. The meta-analysis by van Loon et al. (2020), aimed to evaluate the effectiveness of school-based intervention programs in reducing psychological stress among adolescents and to examine factors influencing their effectiveness. The multilevel meta-analysis incorporated data from 54 studies with a total of 16,475 participants across various countries. Using a three-level random effects meta-analytic model, the study analysed interventions that targeted adolescent stress, required control groups, and pre- and post-intervention assessments. The findings revealed a statistically significant moderate overall effect size for school-based interventions in reducing psychological stress ($d = 0.543, p < 0.001$). The interventions (Table 2) were particularly effective in reducing school-related stress compared to social stress, remained effective in the longer term, and were more effective in selected student groups. These results suggest that school-based interventions can be instrumental in alleviating stress among adolescents, especially when focused on school-related stressors and tailored to students identified as having higher stress levels.

In another study Van Loon et al. (2022) investigated the impact of school-based interventions on physiological stress indicators in adolescents, focusing on cortisol, blood pressure (BP), and heart rate (HR)/heart rate variability (HRV). The analysis included 30 studies with a total of 4,460 participants aged 10 to 18 from various countries. A three-level meta-analytic model was used to analyze studies that featured school-based interventions aimed at improving psychosocial functioning and reported at least one physiological stress-related outcome. The results demonstrated a small but significant overall effect in reducing BP ($d = -0.173, p = 0.014$). However, no significant effect was observed for HR/HRV ($d = 0.134, p = 0.209$), while for cortisol levels a meta-analysis was not conducted due to methodological heterogeneity across the studies. Programs that incorporated mindfulness, meditation, or relaxation techniques and those of higher intensity were associated with larger effects. Notably, significant effects in BP were found only in (cluster) RCTs, not in quasi-experimental designs. These findings highlight the potential of school-based interventions to positively influence physiological stress responses in adolescents.

The meta-analysis by Fulambarkar et al. (2023) evaluated the effectiveness of MBI longer than four weeks in addressing stress, depression, and anxiety among adolescents in school settings. The analysis included nine RCTs with a total of 5,046 adolescents. The results indicated a significant improvement across symptoms of stress, depression, and anxiety, with a significantly small overall effect size (Hedge's $g = 0.33, p < 0.01$). Subgroup analysis showed a significant and moderate effect size for perceived stress ($g = 0.55, p < 0.01$) but the latter was not observed for depression and anxiety. The results were significant when compared with inactive controls such as those on a waitlist or engaged in usual curricular lessons. However, the effects were not significant when the intervention groups were compared with active controls which included students engaged in

interventions such as yoga, relaxation and substance abuse prevention. These findings suggest that while MBI can be effective in reducing perceived stress, their comparative benefits may be less pronounced when measured against other active health interventions.

In their meta-analysis, [Ng et al. \(2024\)](#) evaluated the effectiveness of stress management interventions among U.S. high school students. The analysis included 25 studies involving a total of 3,100 high school students aged 12 to 20 years. The pooled effect size for stress reduction across these studies was calculated as $g = -0.36$ ($p < 0.0001$), indicating a small although significant reduction in stress among the adolescents. The interventions also demonstrated small significant effects in reducing anxiety ($g = -0.31$; $p < 0.0001$) and depression ($g = -0.23$; $p < 0.0001$). Long-term follow-up revealed a more substantial reduction in perceived stress, with an effect size of $g = -0.77$ ($p = 0.019$). However, long-term effects on anxiety ($g = -0.098$; $p = 0.466$) and depression ($g = -0.19$; $p = 0.05$) were minimal. Longer interventions, lasting more than eight weeks, were particularly more effective in reducing anxiety depression compared to shorter interventions ($g = -0.36$ vs. $g = -0.17$; $p = 0.026$) These findings suggest that more extended interventions in duration may provide greater benefits in managing stress, anxiety, and depression among high school students.

Discussion

The primary aim of this review was to identify effective school-based interventions that could be integrated into school curricula to mitigate sub-clinical anxiety and stress among adolescents. The findings from the included studies provide valuable insights with numerous implications for both practice and future research ([Tables 1-2](#)).

CBT and MBI

In this review, one school-based CBT randomized controlled trial reported short-term reductions in subclinical anxiety; however, effects were not maintained at 12 months ([Wergeland et al., 2023](#)). Furthermore, in this study higher parental credibility and expectancy were associated with better outcomes, which underscores the importance of parental perceptions and engagement. In addition, the lack of sustained effectiveness indicates a need for longer-term strategies, for example, scheduled booster sessions, to maintain benefits ([Wergeland et al., 2023](#)). Considered alongside the secondary literature in our review, which provides preliminary evidence suggesting that CBT may be beneficial ([Jagiello et al., 2024](#); [Ng et al., 2024](#)), these findings point to the need for adequately powered school-based trials with extended follow-up and explicit parental involvement to determine effectiveness in school settings.

Similarly, MBI, have emerged as promising approaches. Evidence from [Liu et al. \(2023\)](#) and the meta-analysis of [Fulambarkar et al. \(2023\)](#) underscore their efficacy in reducing stress and fostering resilience. These interventions show clear potential for enhancing long term emotional well-being and highlight the need for further exploration into culturally and individually tailored adaptations to ensure equitable and inclusive access for diverse adolescent populations.

Physical Activity

Physical activity interventions, such as yoga, also present opportunities to enhance psychological health among adolescents. Research by [McMahon et al. \(2021\)](#) suggests a modest but positive impact of physical activity on psychological health, but the limited number of studies and variations

in program design hamper the ability to draw firm conclusions. However, the variability in program implementation, as observed across different schools, underscores the importance of standardizing intervention protocols to maximize benefits. Programs must also address practical issues, such as limited time or resources in schools, by designing accessible, time-efficient interventions that can easily integrate into the existing curriculum. Despite these known challenges, the role of physical activity in reducing stress and sub-clinical anxiety warrants further investigation, especially in resource-constrained settings where cost-effective strategies are necessary.

Parental Involvement

Parental involvement emerged as another important factor influencing intervention outcomes, though the evidence remains mixed. Some studies, such as [Wergeland et al. \(2023\)](#), indicate that parental credibility and expectations significantly contribute to the success of school-based CBT interventions, suggesting that parents play an important role as mediators of success. Involving parents through workshops, strategy-sharing sessions, or take-home materials may help amplify positive intervention outcomes. However, barriers to parental engagement—such as time constraints or caregiver strain—must be carefully addressed in the design of future programs.

Intervention Duration and Delivery

A significant observation across the reviewed studies is the mixed findings regarding the duration of interventions. Mixed findings suggest that the quality of intervention sessions may surpass the importance of their quantity. For example, studies such as [Wergeland et al. \(2023\)](#) advocate for the importance of well-structured, shorter sessions that balance comprehensiveness with practical time constraints in schools. Similarly, the “Stress Lessons” program evaluated by [Vogelaar et al. \(2024\)](#) demonstrates that short-term interventions can improve stress knowledge, though they may have limited immediate impact on reducing perceived stress.

Strengths. Our narrative review provides an integrative analysis of various school-based interventions from various geographic locations and educational environments. By focusing on a range of interventions, including CBT, MBIs, and physical activity, the review offers a comprehensive perspective on strategies to reduce sub-clinical anxiety and stress among adolescents. Moreover, the inclusion of recent studies ensures that the findings remain relevant to current academic and clinical practices. Emphasizing interventions aimed at adolescents with sub-clinical anxiety levels at baseline is particularly significant, given this critical developmental period’s potential for long-term mental health benefits. The findings contribute practical recommendations for integrating effective interventions into school curricula, offering insights that may inform policy and practice.

Limitations

The findings of this review highlight certain limitations inherent in the included studies. The studies analyzed in the review have significant differences that makes comparison between studies difficult. Furthermore, a prevalent issue is the small sample size of most primary studies and the variability in study designs, such as the use of different methodologies like RCTs versus quasi-experimental studies, which introduces heterogeneity and complicates direct comparisons.

One critical limitation is the reliance on the DASS-21 as an outcome measure in several studies. While the DASS-21 is a robust tool for assessing general psychological stress, it is less appropriate

for measuring child-specific anxiety symptoms, potentially leading to an underestimation of intervention effects. Future research should consider employing validated youth-specific tools, such as the Revised Child Anxiety and Depression Scale (RCADS) or the Screen for Child Anxiety Related Emotional Disorders (SCARED), to address this gap (Baourda et al., 2021; Friedberg et al., 2022).

Another limitation is the lack of consistency in follow-up periods for assessing long-term outcomes. Many of the studies focused on short-term outcomes, offering limited insights into the long-term efficacy and sustainability of the interventions examined. Long-term studies are, therefore, essential to better understand whether initial gains persist over time. Furthermore, a limitation of this review is that our search strategy focused on intervention effectiveness and may not have captured studies primarily reporting harms or adverse effects. Future systematic reviews could expand the scope to critically evaluate both benefits and risks. Finally, differences in cultural and socioeconomic contexts, as well as variations in program implementation, may limit the generalizability of findings. Differences in intervention implementation, such as whether programs are delivered by teachers or external facilitators, lead to varied outcomes, making it challenging to draw definitive conclusions about the effectiveness of specific interventions. Moreover, external factors, including parental involvement and school environments, are not consistently explored or controlled, affecting the perceived intervention effectiveness. Addressing these variables systematically in future research will enhance the robustness of findings.

Practice Implications. This review highlights that school-based psychoeducational interventions can be beneficial for mitigating stress and sub-clinical anxiety in adolescents, particularly through evidence-based approaches such as CBT and MBI. The latter are particularly effective approaches that improve emotional regulation and psychological resilience. Schools should focus on incorporating these methods into their curricula, with clear emphasis on practical feasibility and accessibility for adolescents.

While our review highlights the benefits of school-based interventions, it is important to acknowledge potential risks. Recent research, such as Guzman-Holst et al. (2025) has documented instances of iatrogenic harm, among certain subgroups including individuals deemed at high risk of mental health problems, male participants, and younger children and children eligible for free school meals. Approximately 8.93% of these programs were associated with negative outcomes, such as increased anxiety or worsened well-being. These findings underscore the need for thorough monitoring and rigorous design to ensure programs are both effective and safe (Guzman-Holst et al., 2025). Notably, our literature review focused only on healthy adolescents without mental health disorders and did not provide evidence for harmful effects on the participants (Tables 1 and 2).

The findings of this review also highlight the importance of parental involvement. Evidence from Wergeland et al. (2023) and other studies underscores the role of parents in amplifying the effectiveness of school-based interventions. Schools should actively engage parents through take-home workshops, newsletters, and shared resources to promote home-based reinforcement of strategies taught during interventions. Structured parental participation could further support adolescents in maintaining long-term benefits from these programs.

Additionally, this review supports the inclusion of physical activity interventions as part of a holistic approach to promoting adolescent mental health. While yoga programs, as evaluated by McMahon et al. (2021), have shown potential for improving psychological health, more rigorous studies are needed to standardize these practices and evaluate their efficacy across broader populations.

Lastly as suggested by [Friedberg et al. \(2022\)](#), integrating creative and engaging formats into psychoeducational interventions—such as multimedia tools, interactive simulations, or arts-based therapies—could improve outcomes by enhancing engagement and retention.

Implications for Research

Future research should aim to address several knowledge gaps identified in this review. First, the development of culturally tailored interventions is crucial to ensure equitable and inclusive access to effective mental health interventions. Standardized tools that factor in cultural and linguistic variations, as well as interventions designed for low-resource settings, are needed to expand the reach and utility of school-based programs. Second, longitudinal studies should be prioritised to evaluate the sustainability of intervention outcomes over extended periods. This will provide a clearer understanding of whether initial improvements in emotional regulation and resilience persist into adulthood.

Innovative delivery methods may improve accessibility and engagement, especially in underserved areas. Technological innovations, such as mobile applications or virtual reality platforms, may also play a role in enhancing accessibility and engagement with school-based interventions. These tools could allow programs to extend beyond the physical classroom and provide ongoing support for adolescents who may not have access to in-person facilitation.

Alongside this, evaluation frameworks combining qualitative and quantitative assessments can provide a comprehensive view of intervention effectiveness. In addition, a focused examination of parental involvement's role and its potential to enrich intervention outcomes is crucial. Insights from existing studies suggest parents' engagement could significantly amplify the benefits of school-based programs. Finally, future research should incorporate evaluations of potential adverse outcomes alongside benefits to ensure a balanced understanding of intervention impacts.

Addressing these knowledge gaps would significantly advance the field, improving the design, implementation, and evaluation of school-based mental health strategies to promote the well-being of adolescents globally.

Conclusion

This review highlights the substantial potential of school-based psycho-educational interventions in mitigating sub-clinical anxiety and stress among adolescents. CBT and MBI consistently stand out as promising approaches, not only in reducing symptoms of sub-clinical anxiety and stress but also in enhancing resilience and emotional well-being. Physical activity interventions show promise, though further investigation is needed to standardize and evaluate their efficacy. Additionally, the review underscores the importance of factors such as parental involvement and well-structured session delivery in optimizing intervention outcomes.

Future research should focus on tailoring interventions to diverse cultural contexts, exploring their long-term impact, and leveraging technological tools to expand their reach. Although adverse events were not reported in the studies included in this review, other research has documented potential unintended effects of school-based psychological interventions; therefore, programs should be implemented cautiously with routine outcome monitoring, opt-out options, and clear referral pathways. By addressing these areas, school-based programs can play a crucial role in enhancing mental health and resilience among adolescents, ultimately contributing to their overall well-being.

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Ethical Considerations

This paper is a narrative review and therefore there was no need to submit a protocol for ethical approval.

Consent to Participate

This paper is a narrative review and therefore no patients were involved in the current paper and there was no need to receive patient consent.

Author Contributions

The conceptualization of the study was a collaborative effort led by AP, PA, AQ, HC, CD, EP, OK, KM, CN, and CC. Methodological design and planning were carried out by AP, PA, ZS, KK, AQ, CD, EP, OK, KM, CN, and CC. Data curation and investigation were performed by AP, PA, ZS, KK, AQ, and CC, while formal analysis of the data was led by AP, PA, AQ, and CC. The supervision of the study was conducted by AP, PA, and CC, ensuring that all aspects met the highest standards of quality and rigor. Visualization of the data and results was managed by AP, PA, AQ, and CC. Project administration was carried out by CC, who oversaw timelines and resource allocation. The original draft of the manuscript was primarily written by AP, PA, ZS, KK, AQ, and CC. Subsequent review and editing involved contributions from all listed authors, including HC, CD, EP, OK, KM, and CN, ensuring the manuscript was refined and met publication standards. The authors have collaboratively brought distinct expertise to the project while maintaining a cohesive and interdisciplinary approach throughout the study. Key to Acronyms: AP: Alexia Papageorgiou; PA: Panayiota Andreou; AQ: Annalisa Quattrocchi; HC: Haris Charalambous; CD: Christiana Demetriou; EP: Elena Philippou; OK: Ourania Kolokotroni; KM: Koralia Michail; CN: Christiana Nicolaou; CC: Constantina Constantinou; ZS: Zoi Savva; KK: Konstantinos Kossenias.

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Supplemental Material

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Annalisa Quattrocchi is an Assistant Professor of Epidemiology, the Associate Head of the Department of Primary Care and Population Health, and the Programme Coordinator of the Erasmus Mundus Joint Master in Public Health (MPH) in Disasters (EMJM PHID) at the University of Nicosia Medical School. Dr Quattrocchi holds a BSc (with Honors) in Biological Sciences from University of Catania (Italy), a MSc (with Honors) in Human Biology (with Honors) from University of Catania (Italy), a PhD in Translational Biomedicine from University of Catania (Italy), and the EPIET (European Programme for Intervention Epidemiology Training) diploma from the European Centre for Disease Prevention and Control (ECDC, Stockholm, Sweden). Her research interests include cancer epidemiology, social determinants of health, nutritional epidemiology and early life exposure on health outcomes, with particular focus on the development of chronic diseases

in adult life. Furthermore, Dr Quattrocchi is interested in the field of infectious disease epidemiology, from surveillance to risk analysis for infection prevention and control.

Dr Haris Charalambous graduated from the University of Southampton Medical School, and subsequently trained in the UK in Internal Medicine obtaining the Membership of the Royal College of Physicians (MRCP) and then trained in Clinical Oncology, obtaining the Fellowship of the Royal College of Radiologists (FRCR) and the certificate of completion of specialist training in the UK (CCST). He worked as a consultant clinical oncologist both in the UK (Poole and Newcastle upon Tyne) and in Cyprus (Bank of Cyprus Oncology Centre). His site specialization is in the treatment of thoracic, urological and thyroid cancers. His main research interests relate to predictive factors for immunotherapy, as well as the integration of palliative care concurrent with oncological care in patients with advanced cancer. Dr Charalambous has also worked with the Cyprus Cancer Registry and the Middle East Cancer Consortium on Palliative Care and epidemiological Cancer Registry projects. Dr Charalambous has participated as a principal or co-investigator in over twenty (20) clinical trials over the years and is a member of the EORTC Lung Cancer Group and the American Society of Clinical Oncology (ASCO). He received research grant awards as a principal investigator from the Royal College of Radiologists in the UK, from Sanofi-Synthelabo, Schering Plough and MSD. He is currently a principal investigator in a phase II Study of Immunotherapy with Pembrolizumab as maintenance therapy for patients with Non-Small Cell Lung Cancer (NCT02705820), including translational research on immunotherapy biomarkers on circulating tumour cells. Dr Charalambous is the author in more than 40 peer review publications, and 4 chapter publications.

Dr Christiana Demetriou is a visiting Associate Professor of Epidemiology and Public Health at the University of Nicosia Medical School. Her research interests include neurological disease and cancer epidemiology, as well as molecular investigation of the common links between chronic diseases (“diseasome”). The impact of nutrition, and more specifically of the Mediterranean Diet in these conditions is of particular interest to Dr Demetriou. In addition, she is interested in the field of biological embedding, the process through which external exposures, and especially early life exposures, become internalized to influence health. Dr Demetriou has participated in several multicentre research projects funded by the European Commission as well as by National Research Foundations. She has also received funding for her research work from the Michael J. Fox Foundation and the European Huntington Disease Network. She has (co-) supervised four PhD students to completion.

Dr Elena Philippou is an Associate Professor in Nutrition-Dietetics at the University of Nicosia, Cyprus. She also holds positions as a Visiting Lecturer in Nutritional Sciences at King’s College London, UK, and as an Adjunct Associate Professor in Nutrition-Dietetics at RMIT University, Australia. Dr Philippou’s research focuses on diet for prevention of degenerative disease and ageing, and more specifically, the effects of the Mediterranean diet, dietary glycaemic index, and chrononutrition on cognitive function, cardiometabolic factors, and rheumatic disease, aiming to identify dietary factors that can improve outcomes. Dr Philippou is the primary investigator (PI) and coordinator of research to design and validate the Cyprus food frequency questionnaire for the assessment of dietary intake of Cypriots, as well as the validation of the Mediterranean Diet Screener (MEDAS) in Cypriot adults. She is also the PI of the NUTRICO cohort study assessing associations between diet, and in particular chrononutrition, and cognitive outcomes in middle-aged adults in Cyprus, and the LIFEMIND study examining associations between chrononutrition, food insecurity, and mental health outcomes. She has supervised several BSc, MSc, and PhD students. Dr Philippou has published several research papers and recommendations and is the editor of the book ‘Glycemic

Index: Applications in Practice', (CRC Press) (total research outputs: 80, h-index: 25). Dr Philippou is a highly active professional with several public outreach activities and National and International collaborations, including the UK Ageing and Nutrient Sensing (AGENTs) Network and the American Congress of Rehabilitation Medicine Neurodegenerative Diseases Networking Group. Dr Philippou also has extensive experience as a registered dietitian and practices advising adults and children on diet-related issues.

Dr Ourania Kolokotroni is an Assistant Professor in Pathophysiology at the Cyprus University of Technology since September 2021. She is a Medical Doctor (BMBS, University of Nottingham, 1999), specialized in the area of Paediatrics and a member of the Royal College of Paediatrics and Child Health, United Kingdom (2004). She got a PhD from the Cyprus University of Technology (2015) where she investigated the prevalence of hypovitaminosis D in adolescent sin Cyprus and the association of vitamin D with asthma and allergies prevalence. Her current research interests are in the area of early life determinants of health and more specifically she is interested in the role of nutrition during pregnancy and early life in the development of obesity and other chronic diseases. Her community work involves promoting healthy pregnancies and natural labour and supporting Breastfeeding through her actions with local NGOs such as Birth Forward (Chair of Scientific Advisory Board) and the Cyprus Breastfeeding Association (Founding Member and President of the Board). She is also an Interim board member of the Cyprus Epidemiology and Public Health Association.

Dr. Koralia Michail is a Special Teaching Staff at the Cyprus University of Technology since January 2021. In 2005 she graduated from the Nursing Department of the National and Kapodistrian University of Athens, where she attended her postgraduate and doctoral studies specializing in pediatric nursing in 2007 and 2012 respectively. In addition to her studies and her collaboration with the University of Athens, Dr. Michail worked for many years at the larger Academic Intensive Care Unit of Greece at Evangelismos Hospital (Athens), acquiring the corresponding professional experience and expanding her educational properties in the hospital setting. Dr. Michail's research activities focus on prevention and health promotion of preschool children and adults, as well as prevention of infectious diseases. She currently teaches the course "Healthcare Associated Infections Surveillance", and is collaborating in teaching of "Child's Nursing Care", while holding the responsibility for nursing students clinical placements. She is an active member of the European Resuscitation Council and volunteers as an ALS instructor.

Christiana Nicolaou, RN (School of Nursing, Cyprus, 1985), BSc (Honours) in Professional Studies -Nurse Education- (Anglia Polytechnic University, UK, 1997), Certificate in Teaching and Learning Methodology (Pedagogical Institute of Cyprus, 2001), PhD in Epidemiology and Biostatistics (Cyprus University of Technology, 2015), joined the Department of Nursing, School of Health Sciences, Cyprus University of Technology (CUT) in September 2007 as Senior Lecturer. Currently she is Assistant Professor (since 2011 at CUT. She is elected member of the Council of the Department of Nursing (CUT) and recently she was elected member of the Council of the School of Health Sciences and CUT Senate for two terms. Her research interests fall within the sphere of the promotion of parental and child health, particularly with respect to health literacy, vaccine hesitancy, antibiotic use and also the epidemiological studies related to: social support, social capital, health-related quality of life, socio-environmental health determinants, social environment, natural environment and epidemiology of chronic diseases e.g. rheumatic diseases. Her research projects and publications are focused on this field.

Constantina Constantinou is a Professor of Molecular Cancer Biology at the University of Nicosia Medical School. Prof Constantinou earned her BA Degree in Biological Sciences (concentration in Microbiology) with Distinction in all subjects from Cornell University, USA and furthered her education with an MSc in General and Medical Microbiology with Distinction from University College London, UK, and a PhD in Biochemistry and Molecular Biology from St George's, University of London, UK. Her academic journey also includes a PgCertHE from the University of Hertfordshire. Prof Constantinou's expertise has been enriched through post-doctoral research positions at St George's University of London, UK, and the University of Cyprus, in the field of molecular cancer biology. Since joining the University of Nicosia in 2010, Prof Constantinou has held various pivotal roles, including Associate Dean for Research, Director of the PhD Programme in Medical Sciences, and Director of the Doctor of Medicine (MD) undergraduate programme. Prof Constantinou is a Fulbright Scholar and has also received prestigious scholarships from the A. G. Leventis Foundation, the Overseas Research Awards Scheme (ORS) and the Wellcome Trust Value in People (VIP) Award. Prof Constantinou's research is centered around cancer biology and oncology, with a specific focus on molecular pathways of tumorigenesis. Additionally, she is interested in the field of lifestyle medicine, exploring the impact of nutrition, exercise, sleep, avoidance of risky substances, stress management, and social relationships, in the prevention and management of cancer and other chronic diseases. Throughout her career, Prof Constantinou has actively participated in numerous research projects funded by national, European, and international agencies. Her research findings have been published in high impact factor journals.