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Original Article:

"YOGA BEATS STRESS" PROVIDES PROTECTION AGAINST POOR MENTAL HEALTH OUTCOMES

Betsy Stephens, LSW
Montclair State University, USA

Karen Mengden, Ph.D.
Private Practice, USA

Faculty Advisor:
Wendy Zeitlin, Ph.D.
Montclair State University, USA

Abstract

This pilot study evaluated an eight-week program that aimed at mitigating the effects of stress for adolescents by providing instruction in yoga, mindfulness and Cognitive Behavioral Therapy. Data collected from nine adolescents who participated in weekly sessions was analyzed to consider changes in perceived stress levels, ability to avoid being overwhelmed by emotions, and level of focus and concentration. Results indicated participation in the program may benefit emotional regulation and improve participants' ability to use stress reducing strategies, manage stress, talk about their experience with stress, and lower their levels of stress. Results of this pilot study did not yield lower levels of perceived stress or higher levels of focus and concentration.

Keywords: yoga, cognitive behavioral therapy, stress, emotional regulation, perceived stress levels, mindfulness, adolescents

AUTHOR NOTE: Please address all correspondence to Betsy Stephens, 10 Beaumont Terrace, West Orange, NJ 07052, USA. Email: stephensb4@monclair.edu

INTRODUCTION

Adolescents in the United States are experiencing greater amounts of stress, leading to greater incidents of mental illness (American Psychological Association, 2020). Myriad sources of stress—gun violence, social media, and the climate crisis—contribute to this hardship (Gislason et al., 2021; see also Kegler et al., 2022; Mir et al., 2023). Not surprisingly, the Covid-19 pandemic compounded this problem. The Centers for Disease Control and Prevention (CDC) reported that more than one-third of high school students experienced poor mental health during the pandemic and even more (44%) reported feeling sad or hopeless within the last year (Centers for Disease Control and Prevention, 2022). Yet the stress levels among adolescents were already increasing before the pandemic. In 2019, the American Academy of Pediatrics reported that mental health disorders in children in the U.S. had surpassed physical conditions as the most common reasons children have impairments or limitations (Green et al., 2019).

In 2020, the number of children ages 12-17 visiting emergency rooms for mental health related concerns jumped 31% above 2019 figures, according to data compiled by the CDC (Leeb et al., 2020). Teens in vulnerable populations, such as LGBTQ+, experience mental health problems at even higher rates as do adolescents in minority populations, and those living in poverty (Depa et al., 2022; Spadola et al., 2020; Zaneva et al., 2022). In addition to mental health issues, elevated stress can lead to poor school performance, irritability that causes strained relations with family and friends, behavioral problems, anxiety, depression, and substance use (Kraag et al., 2006).

Stress occurs when a person's relationship with their environment is taxing, dangerous, or requires more resources (e.g., time, money, or patience) than the person possesses (Kraag et al., 2006). The adolescent brain is in a state of rapid development and change, which makes it more vulnerable to stress (Tottenham & Galván, 2016). Because it is not possible to predict or eliminate external stressors, adolescents would benefit by learning strategies and tools to navigate the stress they experience and lessen the effect it has on their mental and physical health.

This presents a growing need for universal stress management education for adolescents in the US. The current pilot study is an evaluation of an eight-week program called Yoga Beats Stress (YBS), which was developed to provide adolescents with education on stress reduction strategies drawn from yoga, mindfulness and Cognitive Behavioral Therapy (CBT). Yoga is a physical practice that requires practitioners to coordinate the movement of their body with their breath (Piña et al., 2021). Mindfulness is a practice often involving meditation that heightens a practitioner's ability to focus and concentrate (Özcan, 2022). CBT is a form of psychotherapy based on the theory that changes in thinking impact changes in behavior and experience. Thus, this practice involves addressing thoughts about stress and situations that could elicit a stress response (Webb, 2019).

Current Research on Interventions to Address Stress in Adolescents

Currently, successful interventions for mitigating the effects of stress in adolescents include programs focused on mindfulness, yoga, or CBT. These three interventions have been used separately with varying amounts of success. A meta-analysis of 81 studies that focused on youths 18 years old and younger found CBT to be an effective treatment for childhood anxiety disorders (Sigurvinsdóttir et al., 2019). Researchers in Turkey found six weeks of mindfulness instruction to be effective at reducing perceived stress while increasing mindfulness and confidence in academic success for a small group of female students with a median age of 16.77 years (Özcan, 2022). Additionally, researchers in Massachusetts found that 70 high school students who received yoga instruction two to three times a week for 11 weeks became more resilient and were less likely to be overwhelmed by their emotions when compared with a control group (Khalsa et al., 2011). A review of literature on the effects yoga has on children found the physical practice yielded physiological effects indicative of stress relief when compared to other physical activities (Galantino et al., 2008).

A search of the literature did not yield any studies evaluating the impact all three practices together —yoga, mindfulness, and CBT—would have on stress experienced by adolescents. There are, however, a small number of studies that looked at combining yoga and CBT to address stress for adults.

Yoga Combined With CBT

In one pilot study of 22 adults who were diagnosed with treatment resistant General Anxiety Disorder, participants experienced significant improvements in anxiety, depression, panic, and sleep after six weeks of a combined yoga and CBT intervention (Khalsa et al., 2014). This suggests promising results and furthers work that aims to address stress by combining yoga with CBT (Khalsa et al., 2014).

In a qualitative study of 27 adults engaging in a program that combined yoga with CBT, participants reported that practicing yoga heightened awareness of their feelings and helped them calm their minds, both of which allowed them to more fully participate in the program's CBT exercises (Capon et al., 2021).

Thus far, the research involving adolescents facing stress has only evaluated these three practices –yoga, mindfulness and CBT—in isolation. Though the literature does suggest that programs combining yoga and CBT provide an advantage for adults, it is not yet known if adolescents would enjoy the same benefits. The current study seeks to understand this better by exploring the impact of the eight-week YBS program, which teaches adolescents stress coping strategies with a combination of yoga, mindfulness and CBT. We hypothesized that adolescents participating in YBS would experience lower levels of perceived stress and fewer deleterious effects of stress on their mental health.

The YBS Program

The YBS program was developed to help middle school-aged participants manage everyday stress by teaching them strategies from yoga, mindfulness and CBT. The program takes place in the community (i.e., outside of school), consists of weekly 50-minute sessions, and is led by both a certified yoga instructor and a mental health professional. Each group enrolls no more than 10 participants. This allows for meaningful discussions and individual attention for the participants. During each session, participants engage in the physical practice of yoga, learn meditation practices to enhance mindfulness, and practice CBT exercises with the intent of reshaping thought patterns that may otherwise cause them to perceive situations as distressing or hopeless.

YBS participants meet with instructors once a week for eight weeks, ideally, but not always, consecutively. Participants and instructors sit facing each other on yoga mats placed in a circular formation to facilitate discussion and interaction.

Every session focuses on a specific topic relating to stress, such as stress and the teen brain, good stress versus bad stress, sleep and stress, and the impact of social media on stress. Each session includes a discussion of the topic followed by a yoga practice that pertains to the session's topic. For example, during the session on sleep, participants learn a yoga sequence they can practice before bed to ready their bodies for sleep. The yoga practice is rooted in Vinyasa yoga, a form of yoga that links breath to movement in postures that transition smoothly from one to another to form a continuous flow (Piña et al., 2021). Students are instructed to link their movements with their breath, an element of yoga that distinguishes it from other forms of physical activity (Saoji et al., 2018).

Following the yoga practice, participants learn mindfulness and CBT exercises aimed at helping them address the cognitive impacts of stress. For example, students learn an open-eyed mindfulness practice that serves to raise awareness of thoughts and feelings. This is followed by CBT practices, such as recognizing that thoughts including words like “always,” “never,” “everyone,” or “no one,” can lead to negative beliefs, making the thinker believe their situation is unchangeable or hopeless (Mehta & Sagar, 2015).

Every session concludes with a review and discussion of the lesson, breathing or mindfulness technique, and yoga practice. Participants receive handouts that detail the skills learned as well as a prescribed home practice (i.e., “homework”). During the eight-week period, participants learn five different breathing practices, nine mindfulness and yoga techniques, and six strategies from Cognitive Behavioral Therapy. Participants are given the opportunity to practice these strategies during the sessions and are encouraged to practice on their own between sessions.

METHOD

Participants

This pilot study included a total of nine participants and covered a single eight-week term of YBS during the fall of 2022. The ages of participants ranged from 11 to 13 years. Three participants were 11 years old, three were 12 years or younger and three were 13 years old. Five participants identified as White, two identified as Black, and two identified as "other." All but one participant was female. One participant chose to self-describe their gender identity and specified "she, they" for pronouns. All participants had previous experience both with yoga and mindfulness. All but one participant indicated they had tried yoga a few times before starting the session. Only one participant reported having only tried yoga once before. The participants' experience with mindfulness was identical to their exposure to yoga. Students were registered for the community-based program by a parent. Assent was provided by each participant and consent by their parents, as required by the Montclair State University Institutional Review Board.

Measures

At the beginning of the first YBS session and the end of the last YBS session, participants were asked to complete a brief survey. Measures used in this survey included: Perceived Stress Scale (PSS-10), Difficulties in Emotional Regulation Scale Short-Form (DERS-SF), and Mindful-Attention Awareness Scale (Brown & Ryan, 2003; Cohen et al., 1983; Kaufman et al., 2015). Surveys were distributed via Qualtrics and were completed on an electronic device. Printed versions of the surveys were made available for anyone who had trouble completing them on an electronic device. The surveys also gathered demographic information.

To measure emotional regulation, we used the DERS-SF, a scale that consists of eighteen questions with six subscales: strategies, non-acceptance, impulse, goals, awareness, and clarity (Kaufman et al., 2015). Strategies refers to a person's belief that they are able to take steps to successfully navigate an emotionally charged situation. Non-acceptance describes a tendency to either ignore or have a negative reaction to feelings of distress. Impulse measures a person's ability to resist giving in to emotional urges or outbursts. The category of goals measures a person's ability to stay on task during times of emotional distraction. Awareness measures a person's ability to acknowledge their feelings as they arise. Clarity measures a person's ability to correctly identify and make sense of their feelings. Each subscale is measured with three items that each have five possible responses ranging from "almost never" to "almost always." Each subscale is scored using the average of the three items. An example item from the impulse subscale is "When I'm upset, I have difficulty controlling my behaviors." Higher values on each of the subscales indicate more difficulty with emotional regulation. A 15 is the highest possible score on

each item. The lowest possible score, indicating the highest level of emotional regulation, is a 3.

In a sample of adolescent girls aged 13-18, internal consistency for the total instrument reported as Cronbach α was .91 (Kaufman et al., 2015). Cronbach α for the subscales ranged from a low of .91 (Impulsive) to a high of .97 (non-acceptance).

To gauge participants' level of stress, we used the Perceived Stress Scale, a 10-item instrument that measures psychological stress (Cohen et al., 1983). The self-report survey uses a 5-point scale (Never to Very Often) to determine the level of stress its respondents assign to situations in their lives. This scale measures the level at which an event causes a respondent to feel life is overwhelming, unpredictable, and out of their control. For example, participants are asked to respond to the following question: "In the last month, how often have you felt that you were unable to control the important things in your life?" Four of the 10 questions are positively worded and reverse-scored. A sum of all responses yields total scores that can range from 0 to 40. A sum between 0-13 is considered low perceived stress, from 14-26 is moderate stress, and from 27-40 is high perceived stress. This scale was validated for use in adolescents in the US who have mental illness (ages 14-16) with an overall internal consistency score of α=.88 (Whitney et al., 2022).

Another study has found lower internal consistency (Cronbach's α = .70) when using the PSS-10 in early adolescent children with a median age of 12.44 years. This age group is more closely aligned to participants in this study than the aforementioned validation surveys. Those researchers noted a two-factor model of the PSS-10 has higher internal consistency (Cronbach's α = 0.72) in this age group (Kechter et al., 2019), This two-factor model separates PSS-10 items into two subscales, one that examines coping skills and a second that measures perceived distress.

The Mindful Attention Awareness Scale (MAAS) is a validated scale that measures respondents' "objective experimental awareness" (Brown & Ryan, 2003). In other words, this instrument assesses people's observations of their ability to keep a single focus and not be distracted by thoughts outside the task at hand. The survey asks respondents how frequently they engage in activity that would indicate they have lost focus. Responses are collected on a 1 to 6 scale, with 1 indicating "Almost Always" to 6, which indicates "Almost Never." Because the adolescents in our survey do not drive, we deleted the following item: "I drive places on 'automatic pilot' and then wonder why I went there." As a result, the adolescent surveys measured 14, rather than 15, items. To score the MAAS, mean scores for all items were calculated. A higher score is indicative of a stronger ability to maintain focus. The highest possible score for the 14 items would have been 84. This scale has been validated in adolescents ages 14-18 with a Cronbach α = .82 (Brown et al., 2011).

The same participants in similar conditions were assessed both prior to and at the conclusion of the program (i.e., a pretest-posttest design). We looked at descriptive statistics of both numeric and categorical variables to learn how participation in YBS might

impact stress, emotional regulation, and mindfulness. To determine the statistical significance of the difference between pre- and post-intervention scores, we used the Wilcoxon Signed Rank Test. We chose this non-parametric test to accommodate the small sample size and non-normal data (n=9). Due to skipped questions in the pre-test, the sample size was smaller for the emotional regulation measure (n=8). This type of comparison is acceptable when data are at least ordinal. We used Cohen's *d* to determine the effect size, or the magnitude of change, between the measures taken before and after the YBS intervention.

In the post-intervention survey only, participants were asked to self-describe their experience and perceived benefits through a series of three questions. The first question asked participants how YBS helped them handle stress in their lives. They were instructed to answer using a scale of 0 to five with zero indicating "not at all" and five meaning "a lot." The second question asked how often students expected they would use the skills learned in YBS. Participants were asked to answer using a scale of 0 to five with 0 indicating "not at all" and 5 indicating "almost all the time." The final question included four parts. Participants were given a scale of 0 to five. They were told 0 was to indicate "strongly disagree" and five "strongly agree." Participants were then given the following four statements to rate: "I learned information about how to manage stress," "I learned how to talk about stress in a helpful way," "I learned how to accept and handle the stress I experience," and "I learned how to lower my stress levels if/when I need to."

We also observed participant's stress levels through parental observation. Parents responded to a survey that measured their perception of their adolescent's response to stress after completion of the program by asking the following question: "On a scale of 0-5, please indicate how you feel Yoga Beats Stress helped your adolescent handle stress, with 0 meaning it didn't help them at all and 5 meaning it helped them a lot."

RESULTS

On self-reported measures that were only taken after completion of the YBS program, all adolescent participants rated themselves greater than three on a scale of one to five when estimating their ability to successfully use the strategies they learned in the YBS intervention. In particular, they scored themselves highest (M=4.11, SD=0.78) in their ability to use stress reducing skills following the intervention. This indicated they were anticipating using the newly learned skills frequently. Other areas of improvement were seen in the final self-reporting question. Participants reported that they were between "agree" and "strongly agree" for the following: better able to handle stress (M=3.22, SD=1.09), manage stress (M=3.33, SD=1.32), talk about stress (M=3.44, SD=1.32), and lower stress levels if/when needed (M=3.78, SD=0.83). These findings are described in detail in Tables 1 and 2.

Parents who were asked to describe their adolescent's ability to cope with stress after completion of the program indicated an improvement, reporting an average score of 3.33 (SD=0.87) in response to the following prompt: "On a scale of 0-5, please indicate how you feel Yoga Beats Stress helped your adolescent handle stress, with 0 meaning it didn't help them at all and 5 meaning it helped them a lot.

Our sample of only nine participants was not large enough to yield statistical significance on any measure. However, participants did show an improvement on three of the six emotional regulation subscales measured in the DERS-SF. In particular, improvements were seen in emotional clarity, non-acceptance, and strategy. The largest improvement of nearly two points was seen in non-acceptance. Measures for non-acceptance taken before engaging in the YBS program yielded a mean of 8.25 (SD=4.68) compared with a mean of 6.35 (SD=3.58) following the program. A high score of 15 would indicate the greatest difficulty with emotional regulation, while a low score of 3 would indicate the least.

To measure participants' perceived levels of stress, we used the PSS-10. We considered the total score of participants' responses to all 10 questions on the survey. We also took a separate look at subscales that measured coping and perceived distress separately. In all cases, the measures were lower, indicating an improvement, albeit nearly imperceptible.

Measures for stress and mindfulness did not show statistically significant changes from pre- to post-test. Before the program, participants' PSS-10 scores for the perceived stress yielded a mean perceived distress level of 31.89 (SD=5.64) versus a post-test mean perceived stress level of 31.11 (SD=5.46). Individual scores on the PSS-10 form can range from 10 to 50 with higher scores indicating higher levels of perceived stress.

Similarly, pre- and post-program scores for mindfulness remained largely stagnant. MAAS scores taken before the program revealed a mean of 3.23 (SD=1.59). At the conclusion of the program, participants' mean MAAS score was 3.44 (SD=23.5). The highest possible score possible on the MAAS scale is 84 while the lowest possible score is 14. A Wilcoxon Signed Test revealed these negligible changes were not statistically significant.

Table 1. Emotional regulation, stress, and mindfulness

Variable	Pre-test		Post-test		*W*
	Mean	**SD**	**Mean**	**SD**	
DERS Subscales					
Awareness	8.50	2.39	9.75	3.37	23.5
Impulsivity	6.25	2.87	7.5	3.3	23.5
Clarity	7.12	3.31	5.5	1.69	41
Accept	8.25	4.68	6.35	3.58	37.5
Goals	10.38	3.29	10.5	3.93	30
Strategy	6.5	2.33	6.38	1.77	28.5
PSS-10 Subscales					
Coping	11.44	3.28	11.22	2.77	42
Distress	20.44	3.05	19.89	2.93	45
Total stress	31.89	5.64	31.11	5.46	42
MAAS	3.64	1.1	3.5	0.87	33.5

Table 2. What teens learned

Items on a scale of 1-5		
	Mean	**SD**
Able to handle stress	3.22	1.09
Use stress reducing skills	4.11	0.78
Learned to manage stress	3.33	1.32
Learned to talk about stress	3.44	1.32
Learned to lower stress	3.78	0.83

DISCUSSION

The purpose of this pilot study was to determine whether adolescents experiencing stress could benefit from a program that combined lessons from yoga, mindfulness, and CBT. We hypothesized that after participating in the eight-week YBS program, adolescents would experience lower levels of perceived stress and fewer stress-related deleterious effects on their mental health.

The standardized measure we chose for stress (PSS-10) did not show a meaningful decrease in participants' perceived stress levels of adolescents who participated in the eight-week program. This does not support the first half of our hypothesis. However, in the qualitative survey conducted after the eight-week program, participants reported they were better able to manage stress and to lower their stress levels. As mentioned in the limitations below, the suitability of using the PSS-10 for adolescents is currently in question due to the rapid changes taking place in the adolescent brain. This contradiction between the PSS-10 scores and qualitative survey indicates a need for more exploration.

The second half of the hypothesis was not supported; however, qualitative feedback indicated that participants in the YBS program felt more poised to experience fewer stress-related deleterious effects on their mental health. This is evident in the self-reports indicating participants' confidence in their ability to apply the strategies learned to address stress as well as their ability to lessen their levels of stress.

A growing body of research is exploring the unique impact stress has on the adolescent brain. The response differs at this stage of life, in part because the areas of the brain most sensitive to stress—the hippocampus, prefrontal cortex and amygdala—are still developing (Romeo, 2013). However, this is only part of the picture. A study of the adolescent brain in animals reveals that when stress hormones are released, they remain present for 45 to 60 minutes longer than in the adult brain (Romeo, 2013). This research also indicates stress experienced during adolescence shapes stress response patterns in adulthood. This leads us to believe poor responses to stress during adolescence may have an indelible negative effect.

The brain's vulnerability to stress during adolescence makes this a crucial time for learning stress management strategies. Early adolescence is particularly important, as human studies of adolescents reveal greater levels of the stress hormone cortisol are present in children aged 9-13 when compared with those later in adolescence (Romeo, 2013). Thus, developing coping skills that allow for healthy responses to stress could allow adolescents to develop healthier adult stress response patterns.

The data we collected indicates that upon completion of the YBS program, participants are able to use the stress reducing skills they learned and have confidence in their ability to lower the level of stress they are experiencing when needed. This tells us that not only have participants gained healthy responses to stress, but that these responses allow them to impactfully address stress. Additionally, participants' parents observed an

improvement in their adolescents' ability to cope with stress at the completion of the program.

Examples of the healthy stress responses taught during the program included the CBT practice of reframing negative thoughts by noticing "absolute thoughts." Absolute thoughts include words such as "always" or "never." If an adolescent receives a poor grade on a test, an absolute thought might be: "I will 'never' pass this class." This is a thought distortion that generates distress. Reframing this thought could look like: "I didn't do well on this test, but I've done well on other tests in this class, and I can improve on the next one by studying and asking for help from the teacher." This thought is a more accurate depiction of the situation, and it produces less distress. Another healthy stress response YBS participants learned was a breathing exercise that involved extending exhalations. For this exercise, participants inhaled to the count of one and exhaled to the count of two for three rounds. Next, they inhaled to the count of two and exhaled to the count of four for three rounds. Finally, they inhaled to the count of three and exhaled to the count of six for at least three rounds, and longer if they felt it necessary. Because exhalation incites the parasympathetic nervous system, this breathing exercise serves to quiet the sympathetic nervous system that activates the release of stress hormones (Bae et al., 2021).

Our data suggests YBS could be a valuable tool for helping adolescents develop a healthy response to stress at a crucial juncture in development. Incorporating practices such as these will allow adolescents to lower their current levels of stress. Moreover, by incorporating these practices at this point in their development, adolescents will be setting themselves up for healthy stress response patterns in adulthood which could have a protective effect against future mental health disorders.

Depression is a well-known companion of stress. Research suggests 50-60% of people with a history of Major Depressive Disorder first experienced symptoms of an anxiety disorder. While it is not clear whether maladaptive responses to stress are the cause of disorders such as Generalized Anxiety Disorder (GAD), a strong correlation has been noted. Some research indicates maladaptive responses to stress mediate the relationship between cognitive factors and GAD (Mahoney et al., 2018). GAD has multiple comorbidities including substance abuse, panic and social phobias (Kaufman & Charney, 2000).

None of the measures for emotional regulation in this study achieved statistical significance. However, the specific triad of mood regulation subscales (clarity, strategies and non-acceptance) that showed improvement is encouraging. Difficulty with emotional regulation on a whole is related to higher levels of depression in early to middle adolescence. Meanwhile clarity, strategies and non-acceptance play a particularly important role in regulating emotions (Gonçalves et al., 2019).

Clarity is the first step in regulating emotions (Gonçalves et al., 2019). A problem that goes unnoticed cannot be addressed, and negative emotions that go unchecked can grow to levels that cause distress. A deficit of emotional clarity in adolescents has been

associated with depression and anxiety, self-harming behaviors, and maladaptive social consequences such as aggression, isolation, and lower social status (Blöte & Westenberg, 2019; Palmer et al., 2018; Rudolph et al., 2020). Conversely, higher emotional clarity can contribute to psychological resilience and protect against self-harming and maladaptive social behaviors (Palmer et al., 2018).

The second step in emotional regulation is to accept the emotional response (Gonçalves et al., 2019). Non-acceptance of an emotional response can lead to suppression, which promotes amplification of an emotion's intensity. The more intense an emotion is, the more difficult it is to regulate. Finally, an adolescent must possess strategies to regulate emotions once they are identified and accepted. Both the non-acceptance and strategies subscales have been cross sectionally related to depressive symptoms in adolescents in at least one study (Neumann et al., 2009).

The data we collected found that after completing the YBS program, participants feel they are able to talk about stress. This indicates participants are able to recognize and identify the feeling. Some ways the YBS program facilitated this included discussions focused on exploring where stress is felt in the body and its physical manifestations. For example, stress can be felt in the hands and physically presents as balled fists or picking cuticles. Stress can also show up in the face and present as a furrowed brow or a clenched jaw. Acceptance of these feelings was encouraged through a meditation that encouraged participants to notice feelings and label them. This lesson included a discussion of the purpose all emotions serve, even emotions often thought of as "bad." For example, though too much stress can have negative effects, some stress is necessary to motivate us to move toward a goal or to increase our alertness when greater attention or focus is required (de Kloet & van der Werff, 2016).

The protective effect both healthy responses to stress and better emotional regulation has over future mental health would benefit adolescents living in a world where stressors are poised to increase and persist. Adolescence is, in fact, a crucial time to develop these skills as it is a time with the brain is vulnerable to stress and when patterns for stress responses in adulthood are formed. Programs incorporating yoga, mindfulness and CBT could be incorporated into a school health and physical education program to help adolescents address the impact of the stressful world they live in.

Our study extends prior research that shows yoga, mindfulness, and CBT to be beneficial methods for providing adolescents with the means to address stress. Additionally, it builds on the body of literature by evaluating a program that instructs adolescents to address everyday stress through the combined use of all three methods.

Limitations

This pilot study faced a number of limitations, including small sample size, inconsistency of practice, and timing of surveys. Because there was a small sample size (n=9), it is not possible to generalize the findings of the current study. This weakness was

addressed, in part, by using nonparametric comparisons. However, we recommend replicating the study with a larger sample size under more rigorous conditions in the future, particularly because qualitative findings indicated benefit to participants.

Ideally, participants would have been able to meet for eight weeks consecutively to allow for information to be retained so participants could build on strategies learned from week to week. In the current study, this was not possible due to legal holidays and instructor illness.

Finally, the survey taken at the start of the study, which was meant to establish baseline stress levels, occurred during the participants' second week of school. This is not a particularly stressful time as the normal demands associated with school have not yet gotten underway and there has not been time for stressful social situations to develop. The study ended the week before winter break, which is a time when participants were under more pressure both academically and socially. This might explain why participants' stress levels did not drop by a larger amount. The findings from our study, then, did not control for changing environmental stressors. Future research should control for time-sensitive everyday stressors (e.g., school demands, social conditions). A replication with a larger sample with a comparison group and an expanded understanding of environmental stressors would be more helpful in determining whether YBS remediates everyday stress. Additionally, because participants would need time to use these strategies before an impact on stress levels would occur, we would suggest a follow-up measure at least three months after completion of the program.

Because the ages of participants spanned the years of 11 through 13, it was difficult to find validated measures to accommodate all ages of our sample. While we utilized measurements validated for adolescents, it is not clear if all scales were valid for our sample. Additionally, while the PSS-10 is a validated scale for measuring perceived stress, the use of this measurement is becoming controversial in adolescents, as an understanding of the transitory state of the adolescent brain grows. Adolescence is a time of rapid development and change. Part of this development involves a brain rich with stress hormone receptors, which impacts the response to stress (Tottenham & Galván, 2016). For this reason, some researchers have proposed re-focusing adolescent stress measures to capture attributes that provide adolescents with protection against the detrimental consequences of stress – such as a mindful disposition and executive function– rather than the response to stress itself (Kechter et al., 2019).

Conclusions

This pilot study suggests interventions that include yoga, mindfulness, and CBT could improve adolescents' ability to cope with stress and may also positively impact emotional regulation. These are needed skills in a world where adolescents are faced with a growing number of stressors, universal interventions are needed to guard against higher

rates of depression, self-harm, and anxiety disorders. A larger more rigorous study is merited.

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AUTHOR INFORMATION:

Betsy Stephens received her master's in social work from Montclair State University, which furthered her interest in helping children cope with mental health challenges. She began this focus in 2013 while teaching yoga and mindfulness to children. In 2017, Betsy collaborated with child psychologist, Dr. Karen Mengden, to create a curriculum that addressed stress by blending strategies from yoga and mindfulness with those from cognitive behavioral therapy. Betsy also holds certifications as a Certified Yoga Instructor (RYT 200-hour) and a Certified Kids Yoga Instructor (RYKT 90-hour).
Address: Betsy Stephens, 10 Beaumont Terrace, West Orange, NJ 07052, USA.
Email: stephensb4@montclair.edu

Karen Rochelle Mengden earned her PhD in Educational Psychology with a specialization in school psychology and child development at the University of Minnesota. She currently works as a psychotherapist in private practice with children, adolescents, and adults. She is cognitive-behavioral therapist with experience with individuals and groups and completes psychoeducational evaluations. She helped develop and pilot the Yoga Beats Anxiety program as well as a correlate program, Yoga Beats Stress.
Address: Dr. Karen Rochelle Mengden, 214A Millburn Ave, Millburn, NJ 07041, USA.
Email: karen.mengden@gmail.com

Wendy Zeitlin is an Assistant Professor in the College of Humanities and Social Sciences at Montclair State University whose research focuses on child well-being with an emphasis on disabilities. Since 2017, Dr. Zeitlin has conducted community-based research exploring how parents with intellectual disabilities fare in child welfare systems. As a result of this research, she has authored several mixed-methods and quantitative studies published in top-tier journals. As part of her focus on child well-being, Dr. Zeitlin has been working with the New Jersey Department of Health to study recommended follow-up from the state's Early Hearing Detection and Intervention Program (EHDI). Additionally, her work has been presented at national and international conferences.
Address: Dr. Wendy Zeitlin, Department of Social Work and Child Advocacy, Montclair State University, 1 Normal Ave., Montclair, NJ 07043, USA.
Email: zeitlinw@montclair.edu