

A Pilot Study of a Trauma-Informed Yoga and Mindfulness Intervention With Young Women Incarcerated in the Juvenile Justice System

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This pilot study examined an 8-week yoga-mindfulness intervention with girls in the juvenile justice system. Pre- and posttest data were collected via the Mindful Awareness and Attention Scale for Adolescents (MAAS-A). Paired *t* tests demonstrated a significant increase in mean MAAS-A scores.

Keywords: trauma, incarcerated girls, yoga, mindfulness, juvenile justice system

The rate of trauma-affected youth within the juvenile justice system surpasses the rate of the general population by 10% to 15%, a rate that may be larger if youth with undiagnosed posttraumatic stress disorder (PTSD) are included (Abram et al., 2004, 2007; Copeland et al., 2007; Mueser & Taub, 2008). Nearly 75% of youth in the juvenile justice system have experienced trauma (Epstein & Gonzáles, 2017). These rates indicate a need for trauma-informed care and treatment for this population (Leitch, 2017). Leitch (2017) suggested that unresolved trauma in youth who are incarcerated is exacerbated by negative emotional and behavioral conditions in U.S. prisons. In light of this, she conjectured that inmates and correctional officers alike would benefit from the creation of environments and approaches based in neuroscience that support skills for self-regulation. Neuroscientific studies document that trauma affects up- and down regulated arousal states in the autonomic nervous system (ANS) and point to the promise of neuroplasticity and resilience in youth (Leitch, 2017). Neuroscience also demonstrates that mind-body interventions enhance regulation of the ANS (Marchand, 2014). Therefore, neuroscience suggests that building resilience in the ANS may allow youth to develop self-regulation skills in the face of trauma histories and harsh institutional environments, underlining the role that mind-body interventions can play in enhancing social and emotional outcomes (Leitch, 2017). Trauma-informed, mind-body interventions offer an approach to

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practices that empower youth to understand their neurobiology and its link to emotional and behavioral reactivity as well as develop the capacity to cope with stress and skills for self-regulation (Leitch, 2017). The purpose of the current pilot study was to evaluate the feasibility of a manualized 8-week trauma-informed yoga and mindfulness-based intervention designed to address the multifaceted self-regulation needs of young women who are incarcerated.

Self-regulation is an important skill that is differentiated from actions that manifest as obedient, rule-adhering behaviors (Compas, 2006). In contrast to actions that appear as concrete rule compliance,

Self-regulation involves the ability to: (1) consciously focus attention; (2) be aware of the environment and one's own physical and emotional body states; (3) draw on memory in order to learn from the past and adapt effectively in the present; and (4) maintain or regain emotion states that provide a genuine sense of well-being and lead to further self-regulation. (Ford & Blaustein, 2013, p. 672)

These abilities play a distinct role in building the capacity for self-regulation among youth who are incarcerated (Ford & Blaustein, 2013).

Mind-body interventions, often called somatic interventions, aim to develop the self-awareness that allows for self-regulation in a context of present-moment awareness. Scholars suggest that somatic interventions that involve three primary components—physical yoga forms, focused breathing, and mindfulness—have benefits that address trauma symptoms and build resilience (Epstein & Gonzáles, 2017). Emerging neuroscientific studies suggest theories that explain how and why these interventions show promise for developing self-regulation, stress reduction, and reduction of trauma-related symptoms. Although detailed coverage of neuroscientific theory and evidence is beyond the scope of this article, in brief, scholars hypothesize that yoga offsets the influence of stress because it activates the parasympathetic nervous system and GABA (gamma aminobutyric acid) neurotransmitters and can reduce allostatic load, in part, by engaging the vagus nerve (Streeter et al., 2012), which acts as a messenger to engage the calming, regulatory functions of the parasympathetic nervous system (George et al., 2003). Neuroscientific evidence supports this theory, citing that mind-body practices affect parts of the brain that coincide with emotion regulation and focused attention (Marchand, 2014).

Social science research on mind-body interventions also provides evidence for the positive effects they can have on individuals within general and clinical populations. Randomized controlled trials (RCTs) of mind-body programs for youth in nonclinical populations demonstrate the interventions' favorable influence on emotion regulation, physical health, academic achievement, and relationships with others (Mendelson et al., 2010; Sibinga et al., 2011). In addition, Biegel et al. (2009) found that an RCT comprising an 8-week course in meditation lowered anxiety and depression and enhanced self-esteem and quality of sleep among youth in an outpatient psychiatric treatment setting. Research, mainly on adult

clinical populations, demonstrates the usefulness of mind-body activities (e.g., yoga, breath awareness, traditional Chinese medicine movement practices such as tai chi and qigong, secular mindfulness programs such as mindfulness-based stress reduction) for enhancing self-efficacy in women who have survived domestic violence (Franzblau et al., 2006) and reducing PTSD symptoms (Descilo et al., 2010; Kim et al., 2013; Kirlin, 2010; Rhodes et al., 2016; van der Kolk, 2006; van der Kolk et al., 2014).

There are few empirical studies examining the efficacy of trauma-informed, mind-body interventions with youth who are incarcerated. Epstein and Gonzáles's (2017) review suggests that when mind-body interventions are applied within a trauma-informed context, they result in enhanced capacity for self-regulation, enriched relationships, and increases in physical and neurological wellness. However, gaps remain in the extant research on trauma-informed, gender-responsive somatic interventions and how they benefit juvenile justice-involved girls (Epstein & Gonzáles, 2017).

The current study aims to narrow this gap with a pilot study of a trauma-informed yoga and mindfulness intervention for young women incarcerated in the juvenile justice system. The following literature review discusses the importance of mind-body, trauma-informed interventions for youth who are incarcerated; describes how mind-body therapies affect the ANS and intervene in a manner that cognitive and narrative-based talk therapies alone may be limited in doing; and reviews research on mind-body interventions with youth who are incarcerated.

Trauma-Related Needs and Treatment of Incarcerated Youth

The recent decade has brought advancements in public understanding of the prevalence of trauma in youth in the juvenile justice system and the importance of using an informed values-based approach to address trauma-related needs, often referred to as trauma-informed care (e.g., Substance Abuse and Mental Health Services Administration, 2015). The prevalence rate of trauma-related problems of youth in detained settings is twice that of similar youths in the community (Abram et al., 2004). Although youth of all genders with trauma-related problems are overrepresented in the juvenile justice system, girls in this population reported higher adverse childhood experience (ACE) scores than boys (New Mexico Sentencing Commission, 2016), and 31% of girls compared with 7% of boys in the juvenile justice system reported an ACE in the sexual abuse category (Baglivio et al., 2014).

In response to the prevalence of trauma among youth who are detained, child welfare and juvenile justice systems are investing in emerging models that seek to create systemwide changes and practices to more effectively treat trauma (Ford & Blaustein, 2013). Many of these models rely primarily on disseminating an information-based approach to understanding trauma and suggestions for treatment policies rather than effective forms of clinically appropriate interventions informed by neuroscience that are

accessible to this population (Leitch, 2017). Scholars have suggested that neuroscientifically informed views of trauma have not been operationalized into interventions used by systems serving vulnerable youth and have noted the importance of integrating neuroscientifically informed interventions into models of care (Ford & Blaustein, 2013; Leitch, 2017). Others have noted the absence of somatic practices in these interventions and a dearth of rigorous testing of somatically based interventions (Arvidson et al., 2011; Warner et al., 2014).

In addition to this gap in neuroscientifically operationalized and empirically validated interventions, many commonly used youth-focused trauma interventions are not effective with youth who have disruptive behavior problems. These interventions often require conditions not available to youth who are detained. For example, trauma-focused cognitive behavior therapy, which is an empirically validated trauma intervention for adolescents (Cohen et al., 2016), requires an absence of self-harm or suicidal behavior, safety from further trauma exposure, and supportive and consistent parent/caregiver participation (Ford & Hawke, 2012; Hodgdon et al., 2013). Attachment regulation and competency that target attachment and trauma-related self-regulation problems require caregiver participation (Arvidson et al., 2011; Hodgdon et al., 2013), which is often not feasible for incarcerated youth.

Neuroscientific Implications for Treating Trauma in Youth Who Are Incarcerated

As many juvenile justice and child welfare systems move toward adopting a trauma-informed care approach in their philosophy of service delivery, a need remains for well-defined, neurologically informed, and practical intervention models that can help youth build capacity for self-regulation in a trauma-sensitive manner (Epstein & Gonzáles, 2017; Leitch, 2017). Recent clinical and neurological understandings of cumulative childhood trauma suggest that trauma can result in a range of internalizing and externalizing problems, including poor affect regulation, aggressive and impulsive behavior (Hodgdon et al., 2013), dissociative symptoms, self-injurious behavior (Spinazzola et al., 2011), altered executive functioning (Lanius et al., 2015), hyper- and hypoarousal of the ANS (Lanius et al., 2015), and mood disturbances (Cloitre et al., 2009). The somatic basis of self-regulatory deficits at the center of these functional problems poses significant challenges (Cloitre et al., 2009; Lanius et al., 2015), and mind-body interventions may be a useful approach for treating youth who are incarcerated and who often have complex trauma histories and PTSD symptoms.

PTSD symptoms involve activation in the area of the brain that supports intense emotion, whereas those areas that integrate experience, cognition, and arousal modulation are underactivated (van der Kolk, 2006). As a result, individuals who survive trauma are compromised in their ability to

communicate their experience in words (Levine, 1997; Ogden et al., 2006; van der Kolk, 2006). Neurologically informed, somatically based skills, such as those found in yoga and mindfulness-oriented interventions, target psychophysiological regulation of the nervous system rather than placing primacy on use of words, insight, cognition, and emotion (Leitch et al., 2009; Levine, 1997; Ogden et al., 2006; van der Kolk et al., 2014). Given that talk therapies involve reliance on areas of the brain that are underactivated during stress and affected by PTSD symptoms, a case is made for the importance of helping survivors of trauma regulate physiological arousal via mind-body skills rather than relying on talk therapy alone (van der Kolk, 2006).

In addition, people who have PTSD characteristically have challenges with overactive fight, flight, or freeze responses (sympathetic arousal) and difficulty modulating between hyperaroused or dissociative and relaxed states. In other words, once they are physiologically activated, these individuals have difficulty returning to a zone of balance within the ANS or what scholars refer to as a window of tolerance or resilient zone (Leitch, 2017; Ogden et al., 2006; Seigel, 1999, 2007). Trauma-related impairment causes a narrowing of this resilient zone or window of tolerance where the range of experiences that can be managed without undue distress is diminished (Leitch, 2017; Ogden et al., 2006; Seigel, 1999, 2007). Mind-body interventions show promise in broadening the window of tolerance by engaging the practice of somatic skills that improve self-regulatory capacity by building interoceptive and cognitive awareness of ANS arousal states. This dynamic state of somatic and cognitive awareness positions individuals to shift states of physiological arousal and use more effective coping responses to perceived or real threats (Emerson & Hopper, 2011; Ford & Hawke, 2012; Leitch et al., 2009; Levine, 1997; Ogden et al., 2006; van der Kolk et al., 2014; Warner et al., 2014). Furthermore, van der Kolk (2003) suggested that those who survive trauma require some form of somatically focused intervention to attain a sense of safety and mastery over highly dysregulated bodily experiences resulting from chronic trauma exposure.

Evidence for Mind-Body Interventions With Youth Who Are Incarcerated

Scholars have documented the proliferation of yoga-based programming as a self-regulatory tool for youth at risk and for those already involved in the juvenile justice system (Deitz & Rajan, 2017; Epstein & Gonzáles, 2017). Although these types of programs are being utilized in detention settings (Epstein & Gonzáles, 2017; van der Kolk, 2003), there is a dearth of controlled studies on their effectiveness for youth in this population. One pilot study examined an intervention that included yoga, meditation, and breathing and found reduced perception of stress and improved self-control in a sample of predominantly African American male and female youth

detained in the juvenile justice system (Niroga Institute, 2010; Ramadoss & Bose, 2010). Several studies on nonsomatic mindfulness interventions with incarcerated youth yielded favorable outcomes. One of these studies targeting substance abuse with youth who were incarcerated demonstrated significant gains in impulse control and awareness of personal risk for drug use, but not for self-regulation (Himelstein, 2011). Another study that examined the efficacy of mindfulness training as an adjunctive intervention to individual therapy for incarcerated youth found that youth who received mindfulness training and individual therapy demonstrated larger gains in self-esteem and staff ratings for positive behavior compared with youth who received only individual therapy (Himelstein et al., 2015). A pilot study of mindfulness training aimed at self-regulation and stress found decreases in perceived stress and increases in healthy self-regulation among male youth detained in the juvenile justice system (Himelstein et al., 2012). The same intervention conducted with a different sample of male youth who were incarcerated showed an increase in capacity for self-regulation but not for stress or impulsivity (Barnert et al., 2014). A pilot study of a non-yoga-based intervention targeting somatic regulation in polyvictimized female youth in residential settings resulted in reduced symptoms of depressed mood and hyperarousal (Warner et al., 2014). These studies represent promising but limited empirical evidence on somatically focused interventions with youth who are incarcerated; however, with the exception of Warner et al.'s (2014) study, none of the interventions were specifically trauma informed or trauma sensitive.

There are few, if any, known empirical studies of trauma-sensitive yoga aimed specifically at young women who are in incarcerated. However, empirically rigorous yoga studies on adult women with chronic PTSD provide promising evidence for yoga's efficacy in addressing trauma symptoms in females. In one of the first RCTs studying the efficacy of trauma-sensitive yoga as a PTSD intervention, van der Kolk et al. (2014) examined a 10-week intervention, Trauma Center Trauma-Sensitive Yoga (TCTSY), in a sample of 64 women with chronic treatment-resistant PTSD. Participants in the TCTSY group reported decreased tension and depression and were more likely to no longer meet criteria for PTSD (van der Kolk et al., 2014). A follow-up study completed 1.5 years after this initial RCT found that the frequency with which the women practiced yoga predicted greater decreases in PTSD and depression symptom severity and a greater likelihood of no longer meeting PTSD criteria (van der Kolk et al., 2014). A subsequent study on a 20-week version of TCTSY that included a closely monitored home-based yoga practice found that women experienced significant and enhanced reduction in dissociative symptoms, with 83% of the women no longer meeting criteria for PTSD (Price et al., 2017). Price et al. (2017) noted that given the treatment-resistant nature and chronicity of PTSD symptoms in their sample, it is possible that yoga may serve as a primary opportunity and means for PTSD resolution. These findings suggest that longer treatment

duration and self-guided practice can lead to greater symptom reduction and continued improvement posttreatment (Price et al., 2017; van der Kolk et al., 2014). Although these studies focused on adult women, in the absence of similar studies on young women who are incarcerated, we presented their findings to illuminate the potential efficacy of trauma-sensitive yoga interventions with detained young women.

Given the emerging need throughout the literature for operationalized and neuroscientifically informed somatic interventions for detained young women affected by trauma and the lack of empirical validation for such models of intervention, we conducted a pilot study to examine the feasibility of Mind Body Self Regulation Yoga® (MBSRY), a trauma-informed yoga and mindfulness intervention for young women incarcerated in the juvenile justice system. Pilot studies are an imperative first step to examine new interventions in order to learn about feasibility and consider any changes one ought to make before pursuing a larger trial (Leon et al., 2011).

Purpose of the Study

The current pilot study of MBSRY explores two research questions: (a) Is there benefit that MBSRY offers incarcerated young women? and (b) Is MBSRY a feasible intervention for incarcerated young women? As the literature review suggests, mind-body interventions are becoming more common in juvenile justice settings, and limited existing research suggests their efficacy for this population. However, few studies focus exclusively on trauma-informed somatic approaches, and few studies are aimed directly at incarcerated young women. The prevalence of young women in the juvenile justice system who are trauma affected in conjunction with research indicating the promise of mind-body interventions to improve self-regulation among people who have survived trauma indicates the need for further evaluation of these types of interventions among youth in juvenile justice settings. The present study aims to add to this literature.

Method

Participants and Facility Context

Participants were 52 young women incarcerated in a 40-bed residential treatment program within the highest secure female facility of a state juvenile correctional system in the southwestern United States. This facility was chosen because the facility administrators made this novel form of intervention available to the detained young women. MBSRY was chosen as an intervention because there were no known neuroscientifically specific, empirically validated or manualized somatic interventions known to have been disseminated in the literature at the inception of the project. As a pilot study, demographic data for the 52 participants were unavailable because data were collected for quality assurance and clinical tracking

purposes and provided for analysis in a deidentified format as approved by the institutional review board.

The facility demographics include girls and young women ages 13–21 years who generally represent a mix of African American, Latina, Native American, and White youth. These residents are generally overrepresented, with histories of involvement in the child welfare and juvenile justice systems, multiple placements outside the home, co-occurring mental health and addiction challenges, and single-incident trauma as well as complex/childhood or developmental PTSD.

The MBSRY intervention was open to all residents, and participants were referred by a multidisciplinary treatment team, including clinical providers and a juvenile justice case manager who determined the client could benefit from participation. Young women demonstrating severe safety risk (e.g., acute aggression or self-injurious behavior) or assessed to have difficulty tolerating a group experience were generally, but not always, excluded.

Instruments

Mindful Attention and Awareness Scale–Adolescents. The Mindful Attention and Awareness Scale–Adolescents (MAAS-A; Brown et al., 2011) served as the dependent variable in this study. The scale has been validated for use with healthy and psychiatric adolescent populations (Brown et al., 2011). It has 14 items, such as “I find it difficult to stay focused on what’s happening in the present,” “I tend not to notice feelings of physical tension or discomfort until they really grab my attention,” and “It seems I am ‘running on automatic’ without much awareness of what I’m doing” (Brown et al., 2011, p. 1026). A 6-point scale notes frequency of experiences, where 1 = *almost always* and 6 = *almost never*. Larger scores reflect more mindful awareness.

According to Brown et al. (2011), the items are worded so respondents report a lack of mindful awareness as opposed to a capacity for mindful awareness because “the indirect assessment approach may be more ‘diagnostic’ of mindfulness than are direct claims to mindfulness, particularly for respondents untrained in it” (p. 1024). This approach of indirect assessment aligns with the fact that it is more common for individuals to experience a lack of mindfulness than to experience the presence of it (Brown et al., 2011). Higher scores on the MAAS-A were “related to higher life satisfaction, happiness, positive affect, and wellness and related to lower negative affect. The scale was also positively related to healthy self-regulation and a lower tendency to use substances to cope with stress” (Brown et al., 2011, p. 1027). The scale demonstrated strong internal consistency ($\alpha = .88$) and strong test-retest reliability (Brown et al., 2011). In our data set, items from the MAAS-A showed moderate reliability ($\alpha = .69$ at pretest and $\alpha = .76$ at posttest).

Mind-Body Life Skills Questionnaire. The Mind-Body Life Skills Questionnaire (MBLSQ) serves as an independent variable in this study and was developed by the second author and a colleague for assessing MBSRY.

Given the originality of the MBSRY intervention, there were no existing instruments for assessing participants' experiences with and receptiveness to it, hence the MBLSQ was developed. The MBLSQ consists of 16 items for rating mood, sleep, use of the skills outside of group, how relevant concepts from the group are for one's life, and how easy it is to understand the concepts. Items are rated on a 10-point scale (1 = *least capacity for an item* and 10 = *most capacity for an item*). The MBLSQ was developed for quality assurance purposes, not for research, and thus was not examined psychometrically. However, in our data set, it demonstrated strong internal consistency ($\alpha = .80$). Four of the items from the MBLSQ were used as dichotomous variables in the current analysis.

Procedure and Data Collection

The institutional review board approved the use of deidentified data for analysis to explore outcomes related to the MBSRY intervention and examine treatment model feasibility. Data for this analysis were derived from quality improvement and clinical outcome tracking completed in conjunction with the MBSRY intervention. Participants completed the MAAS-A (Brown et al., 2011) at the first group session and then completed it a second time between Sessions 7 and 8 of the 8-week group. They completed the MBLSQ only once between Sessions 7 and 8. Those who returned the MAAS-A and MBLSQ received a copy of music used periodically in group.

The 8-week MBSRY intervention was run 11 times over a 3-year period by the second author, who also developed it. The group met for 75 minutes per week over each 8-week cycle. On average, each group had 7.5 participants with an attendance rate of 94%. Although participation was voluntary, the members of the multidisciplinary team who referred the participants encouraged them to commit to the entire 8-week group. Hence, it is not possible to determine whether the girls and young women who participated somehow perceived that their participation was an expectation of the juvenile justice system.

Intervention Development and Description

MBSRY is an 8-week yoga and mindfulness-based somatic intervention that seeks to expand individuals' coping and self-regulation capacity or resilience zone, thereby broadening the range of stressors and life experiences one can tolerate adaptively. Our literature review describes the dearth of empirically validated and manualized approaches to delivering mindfulness and somatically based interventions to detained young women. In response to this need, MBSRY was developed by the second author as a somatic yoga- and mindfulness-based mental health intervention that could be delivered either external to or within existing treatment programs for youth with behavioral self-regulation difficulties. It was manualized to be replicable so it could be subjected to more rigorous empirical study if a pilot study demonstrated its feasibility and potential efficacy.

Development of MBSRY occurred over a 10-year period through literature review, integration of emerging research on yoga and somatic therapies, and the second author's 20-plus years of clinical experience providing trauma-specific somatic interventions to youth undergoing a residential level of treatment in high secure facilities and other trauma-focused and adolescent therapy settings. Development was also influenced by the second author's experience delivering a similar intervention to adolescents in a residential care facility within the child welfare system continuum of care. The teaching methodology was informed by the 8-week pedagogy for introducing mindful awareness practices identified by Kabat-Zinn (2013) via mindfulness-based stress reduction. A strength of this model lies in its ability to convey mindfulness concepts and practices in a secular framework, making it culturally adaptable to diverse groups. As with mindfulness-based stress reduction, MBSRY is informed by the Vipassana meditation tradition and draws from mindful awareness practices such as yoga and tai chi applied with a neuroscientific understanding of trauma and its impact on the ANS. A variety of tools drawn from occupational therapy, such as use of weighted objects like blankets and blocks, are used to encourage autonomic regulatory balance and somatic awareness.

In MBSRY, physical and breathing practices drawn from the hatha yoga tradition (Coulter & Craig, 2001; Svātmārāma, 2002) are introduced in sequences informed by both the mindfulness-based stress reduction pedagogy and neurological literature, emphasizing personal choice, self-awareness, and self-direction. In this regard, practices are taught in alignment with methodology identified as trauma sensitive (Emerson & Hopper, 2011), with a primary focus on invitations to engage in guided opportunities whereby participants may choose to practice interoceptive awareness and become familiar with somatic and regulatory states in a tolerable, protected, and structured environment.

Each MBSRY session lasts 75 minutes, with 5- to 10-minute check-in/check-out periods. The check-in/check-out process is routinized, allowing participants to reflect on their mind-body state with an emphasis on somatic awareness rather than on narrative or cognitive experiences. Check-in/check-out also involves optional but encouraged written reflection utilizing a "mind-body experience summary" form. Verbal sharing is encouraged but optional, and it is purposefully limited to a reflection of one's somatic experience of their body and breath as well as subjective experiences on a continuum of distress to ease. During the check-in period, the facilitator briefly discusses themes relevant for the specific week in the curriculum. The themes focus on practical guidance of simple yoga and breathing practices, mindful awareness of somatic and sensory states, choices within the practices, and invitation to adopt a curious and nonjudgmental stance on somatic and interoceptive awareness. Outside of the check-in/check-out periods, the balance of intervention time is spent on guided nonverbal mindfulness and yoga-based practices.

Data Analysis

Analyses were conducted using SPSS (Version 24). Data from deidentified questionnaires were entered into Excel by a graduate research assistant and opened in SPSS. Descriptive statistics and Cronbach's alphas were run for the MAAS-A. The MAAS-A items were summed to obtain a total score for each participant. Paired *t* tests were run (95% confidence interval [CI]) to examine for change on the MAAS-A over the 8-week group and to answer the first research question, "Is there benefit that MBSRY offers incarcerated young women?" Cohen's *d* was used to calculate effect sizes (0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect; Cohen, 1988, 1992).

Independent *t* tests were conducted to answer the second research question, "Is MBSRY a feasible intervention for incarcerated young women?" For example, we used independent *t* tests to explore the feasibility of MBSRY by examining how the intervention was received (e.g., Did the concepts make sense for the participants' lives? Were the concepts easy to understand?) and whether participants' scores on the dependent variable (the MAAS-A) were affected. Independent *t* tests were also conducted to explore whether using the skills outside of the MBSRY classes influenced participants' scores on the MAAS-A. To that end, four items from the MBLSQ were used as independent variables in this analysis: "I have been able to take skills learned in group to help me manage challenging or stressful situations" ($M = 7.2$, $SD = 2.4$, range = 2–10); "I have been able to take skills learned in group to help me maintain a more positive or relaxed state of being" ($M = 7.26$, $SD = 1.9$, range = 1–10); "The mind-body-health ideas we discussed were easy to understand" ($M = 8.19$, $SD = 2.15$, range = 2–10); and "The mind-body-health ideas we discussed made sense for my life" ($M = 8.2$, $SD = 1.9$, range = 3–10). Because of skewness, each item was dichotomized, with scores above the mean for the item coded as high and scores at or below the mean coded as low. Independent *t* tests (95% CI) were run to compare mean differences on the MAAS-A at posttest for low and high MBLSQ scorers on each of the four items. In light of the multiple independent *t* tests, the Benjamini-Hochberg procedure, which accounts for the false discovery rate, was used to correct alpha level for probability (Benjamini & Hochberg, 1995). As noted earlier, Cohen's *d* was used to calculate effect sizes (0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect; Cohen, 1988, 1992).

Results

Paired *t* Tests

Paired *t* tests demonstrated that participants' scores on the MAAS-A had a statistically significant increase from pretest ($M = 48.8$, $SD = 9.5$) to posttest ($M = 52.7$, $SD = 9.7$), $t(48) = -2.56$, $p = .014$, 95% CI [-6.95, -0.83]. Although the mean difference from pretest to posttest is small, the scores did move

from the second quartile to the third quartile. Cohen's effect size value ($d = 0.37$) suggests a small effect size.

Independent *t* Tests

Independent *t* tests indicated statistically significant differences in the MAAS-A means at posttest between groups that were high and low on three of the MBLSQ items: "I have been able to take skills learned in group to help me maintain a more positive or relaxed state of being" (M low = 49.8, $n = 26$; M high = 55.6, $n = 24$), $t(48) = -2.59$, $p = .013$, 95% CI [-12.16, -1.52], with Cohen's effect size value ($d = 0.65$) suggesting a moderate effect size; "The mind-body-health ideas we discussed were easy to understand" (M low = 48.8, $n = 21$; M high = 55.9, $n = 29$), $t(48) = -2.31$, $p = .025$, 95% CI [-11.43, -0.79], with Cohen's effect size value ($d = 0.76$) suggesting a moderate effect size; and "The mind-body-health ideas we discussed made sense for my life" (M low = 49.3, $n = 24$; M high = 55.9, $n = 26$), $t(48) = -2.53$, $p = .015$, 95% CI [-11.89, -1.36], with Cohen's effect size value ($d = 0.72$) suggesting a moderate effect size. There were no statistical differences between the groups that were high and low on the MBLSQ item, "I have been able to take skills learned in group to help me manage challenging or stressful situations" (M low = 50.65, $n = 26$; M high = 55, $n = 24$), $t(48) = -1.63$, $p = .109$, 95% CI [-9.89, -1.02]; however, Cohen's effect size value ($d = 0.46$) suggests a small effect size.

Discussion

In summary, with the caveat that this study has many limitations, findings suggest that participation in MBSRY improved the participants' mindful awareness and attention as measured by the MAAS-A. The MAAS-A is associated with measures of healthy self-regulation (Brown et al., 2011), and the statistically larger MAAS-A scores at posttest in the current study suggest that MBSRY may enhance self-regulation. In fact, some items from the MAAS-A reflect elements of Ford and Blaustein's (2013) definition of self-regulation. For example, MAAS-A items that assess capacity for noticing physical tension or discomfort in the moment and for avoiding running on automatic (Brown et al., 2011) reflect the self-regulation capacities of "selective and sustained deployment of attention" and "awareness of sensory-perceptual input from the environment and sensorimotor . . . information from within the body" (Ford & Blaustein, 2013, p. 672).

Comparison of the MAAS-A means between the participants who scored high on endorsing the four MBLSQ items and those who scored low indicated significant and nonsignificant findings. Participants who endorsed more use of skills outside of group to help them maintain a more positive or relaxed state had statistically larger MAAS-A means at posttest compared with those who reported less use of the skills outside of the group. Participants who were high scorers for endorsing that the concepts were

easy to understand also had a statistically larger MAAS-A mean compared with those who were low scorers for endorsing this view. Finally, those who were high scorers for endorsing that the concepts made sense for their lives had significantly larger scores on the MAAS-A compared with those who were low scorers on this item. Even though there was a numerical difference in the MAAS-A means for high scorers ($M = 55.00$) and low scorers ($M = 50.65$) on frequency of using the skills to manage challenging or stressful situations, this difference was not statistically significant.

The finding of larger MAAS-A scores for youth who used the skills outside of the intervention suggests alignment with another study's (Price et al., 2017) finding that self-guided practice outside of a trauma-informed yoga intervention yielded more symptom reduction. This alignment, combined with our study's finding of a moderate effect size associated with practicing the skills out of class, suggests that providing opportunities and encouragement for using the skills outside of the intervention is an important element in behavioral health programming aimed at mind-body skills for enhancing self-regulation. Findings such as this are consistent with a growing evidence base suggesting that frequency and repetition of new behavioral practices shape neuroplasticity and reinforce new neural pathways (Doidge, 2007).

The finding that higher MAAS-A scores were found in participants who were above the mean in endorsing that the concepts were "easy to understand" and "made sense for my life" combined with the moderate effect sizes for these items suggests that skills and concepts such as those taught in the MBSRY intervention can be conveyed in a way that is relevant for a diverse group of young women in a high secure incarceration facility. Other scholars suggest the importance of presenting mind-body skills and concepts in ways that are culturally relevant for girls and young women in the juvenile justice system (Epstein & Gonzáles, 2017).

Neuroimaging demonstrates the efficacy of mindfulness-based interventions in addressing conditions characterized by emotional dysregulation (Guendelman et al., 2017). However, there is a dearth of empirical evidence on the efficacy of mindfulness and somatically based interventions with youth in the juvenile justice system. Scholars note the need for well-defined, neurologically informed intervention models that provide practical skills to promote a capacity for self-regulation that may be operationalized within a trauma-informed service system (Leitch, 2017). Although the MBSRY intervention requires further study in RCTs to determine its efficacy, the current pilot study suggests that it may be a viable intervention with young women who are incarcerated.

Limitations

This study is limited by the absence of a comparison group. Participants were engaged in other treatment modalities, and given the absence of a control group, it is possible that other experiences influenced the findings.

The sample came from one incarceration site, making it unclear if findings would apply to other sites. Given the incarcerated setting, there is potential for inflated responses on self-report measures driven by motivation to perform well for their team and increase perceived chances for earlier release. Another limitation is that the group interventionist administered the measures, and participants who had a favorable view of the interventionist might have rated their experiences more favorably. Participants for this intervention were chosen by their clinical team and were more likely to be stable behaviorally, more tolerant of group settings, and less likely to present disruptive behaviors in groups. Because of the use of deidentified data, the absence of sample demographics is also a limitation that did not allow for comparison between age and cultural groups. Moreover, because of the pilot nature of this study, mental health assessment tools, behavioral tracking, and biometric measures were not used. Future variables relevant for study include behavioral tracking and mood symptom measures such as aggressive incidents, measures of anxiety, PTSD, depression, and self-report specific to perceived distress and a capacity for perceived self-control. Biometrics such as cortisol would also provide useful evidence for the efficacy of physiologically focused interventions.

Implications

Findings from this pilot study suggest that MBSRY is a feasible mindfulness and somatically based, trauma-informed intervention worthy of further empirical study in the treatment of youth in the juvenile justice system who have self-regulation challenges. Future study of MBSRY should use more specific mental and behavioral health measures in RCTs, including a monitored component of self-guided skill practice outside of the group sessions.

The high rates of trauma and related behavioral health risks of young women who are incarcerated are well documented but frequently unaddressed. Mind-body interventions have shown promise as an accessible intervention for building self-regulation in this population. Scholars suggest that neuroscientifically informed interventions are important avenues for future research in the treatment of PTSD and related symptoms. (Lanius et al., 2015). Future empirical investigations of yoga and mindfulness-based interventions would inform a much-needed evidence base for improving the lives of young women in the juvenile justice system.

References

- Abram, K. M., Teplin, L. A., Charles, D. R., Longworth, S. L., McClelland, G. M., & Dulcan, M. K. (2004). Posttraumatic stress disorder and trauma in youth in juvenile detention. *Archives of General Psychiatry*, 61, 403–410. <https://doi.org/fktqt3>
- Abram, K. M., Washburn, J. J., Teplin, L. A., Emanuel, K. M., Romero, E. G., & McClelland, G. M. (2007). Posttraumatic stress disorder and psychiatric comorbidity among detained youths. *Psychiatric Services*, 58, 1311–1316. <https://doi.org/fmnz>

- Arvidson, J., Kinniburgh, K., Howard, K., Spinazzola, J., Strothers, H., Evans, M., Andres, B., Cohen, C., & Blaustein, M. (2011). Treatment of complex trauma in young children: Developmental and cultural considerations in application of the ARC intervention model. *Journal of Child & Adolescent Trauma*, 4(1), 34–51. <https://doi.org/c8rbf8>
- Baglivio, M. T., Epps, N., Swartz, K., Huq, M. S., Sheer, A., & Hardt, N. S. (2014). The prevalence of adverse childhood experiences (ACE) in the lives of juvenile offenders. *Journal of Juvenile Justice*, 3(2), 1–23. <https://www.ojp.gov/pdffiles/246951.pdf>
- Barnert, E. S., Himelstein, S., Herbert, S., Garcia-Romeu, A., & Chamberlain, L. J. (2014). Exploring an intensive meditation intervention for incarcerated youth. *Child and Adolescent Mental Health*, 19(1), 69–73. <https://doi.org/f5rpmg>
- Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, 57, 289–300. <https://doi.org/gfpxdx>
- Biegel, G. M., Brown, K. W., Shapiro, S. L., & Schubert, C. M. (2009). Mindfulness-based stress reduction for the treatment of adolescent psychiatric outpatients: A randomized clinical trial. *Journal of Consulting and Clinical Psychology*, 77(5), 855–866. <https://doi.org/c5465q>
- Brown, K. W., West, A. M., Loverich, T. M., & Biegel, G. M. (2011). Assessing adolescent mindfulness: Validation of an Adapted Mindful Attention Awareness Scale in adolescent normative and psychiatric populations. *Psychological Assessment*, 23(4), 1023–1033. <https://doi.org/ftp8sc>
- Cloitre, M., Stolbach, B. C., Herman, J. L., Kolk, B. V. D., Pynoos, R., Wang, J., & Petkova, E. (2009). A developmental approach to complex PTSD: Childhood and adult cumulative trauma as predictors of symptom complexity. *Journal of Traumatic Stress*, 22, 399–408. <https://doi.org/chvt69>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155–159. <https://doi.org/as7>
- Cohen, J., Mannarino, A., & Deblinger, E. (2016). *Trauma-focused CBT for children and adolescents: Treatment applications*. Guilford Press.
- Compas, B. E. (2006). Psychobiological processes of stress and coping: Implications for resilience in children and adolescents: Comments on the papers of Romeo & McEwen and Fisher et al. *Annals of the New York Academy of Sciences*, 1094, 226–234. <https://doi.org/btnsr3>
- Copeland, W. E., Keeler, G., Angold, A., & Costello, E. (2007). Traumatic events and post-traumatic stress in childhood. *Archives of General Psychiatry*, 64, 577–584. <https://doi.org/c36sq4>
- Coulter, D., & Craig, A. (2001). *Anatomy of hatha yoga: A manual for students, teachers, and practitioners*. Body and Breath.
- Deitz, R., & Rajan, S. (2017). Access and barriers to implementing yoga-based interventions for at-risk adolescent youth. *International Journal of Health Promotion and Education*, 55(1), 30–41. <https://doi.org/fmn2>
- Descilo, T., Vedamurtachar, A., Gerbarg, P. L., Nagaraja, D., Gangadhar, B. N., Damodaran, B., Adelson, B., Braslow, L., Marcus, S., & Brown, R. P. (2010). Effects of a yoga breath intervention alone and in combination with an exposure therapy for post-traumatic stress disorder and depression in survivors of the 2004 South-East Asia tsunami. *Acta Psychiatrica Scandinavica*, 121(4), 289–300. <https://doi.org/dgxvpm>
- Doidge, N. (2007). *The brain that changes itself*. Viking.
- Epstein, R., & Gonzales, T. (2017) *Gender and trauma, somatic interventions for girls in juvenile justice: Implications for policy and practice*. Georgetown Law Center on Poverty and Inequality. <http://jjie.org/wp-content/uploads/2016/09/gender-and-trauma.pdf>
- Emerson, D., & Hopper, E. (2011). *Overcoming trauma through yoga: Reclaiming your body*. North Atlantic Books.
- Franzblau, S., Smith, M., Echevarria, S., & Cantfort, T. (2006). Take a breath, break the silence: The effects of yogic breathing and testimony about battering on feelings of self-efficacy in battered women. *International Journal of Yoga Therapy*, 16, 49–57. <https://doi.org/fmn3>
- Ford, J., & Blaustein, M. (2013). Systemic self-regulation: A framework for trauma-informed services in residential juvenile justice programs. *Journal of Family Violence*, 28(7), 665–677. <https://doi.org/btnsr3>

- Ford, J., & Hawke, J. (2012). Trauma affect regulation psychoeducation group attendance is associated with reduced disciplinary incidents and sanctions in juvenile detention facilities. *Journal of Aggression, Maltreatment, and Trauma*, 21, 365–384. <https://doi.org/fmn5>
- George, M., Rush, J., Sackeim, H., & Marangell, L. (2003). Vagus nerve stimulation (VNS): Utility in neuropsychiatric disorders. *International Journal of Neuropsychopharmacology*, 6, 73–83. <https://doi.org/fkntnz>
- Guendelman, S., Medeiros, S., & Rampes, H. (2017). Mindfulness and emotion regulation: Insights from neurobiological, psychological, and clinical studies. *Frontiers in Psychology*, 8, Article 220. <https://doi.org/ggbpr9>
- Himelstein, S. (2011). Mindfulness-based substance abuse treatment for incarcerated youth: A mixed method pilot study. *International Journal of Transpersonal Studies*, 30(1–2), Article 3. <https://doi.org/fmn6>
- Himelstein, S., Hastings, A., Shapiro, S., & Heery, M. (2012). Mindfulness training for self-regulation and stress with incarcerated youth: A pilot study. *Probation Journal*, 59, 151–165. <https://doi.org/fmn7>
- Himelstein, S., Saul, S., & Garcia-Romeu, A. (2015). Does mindfulness meditation increase effectiveness of substance abuse treatment with incarcerated youth? A pilot randomized controlled trial. *Mindfulness*, 6, 1472–1480. <https://doi.org/f77qsk>
- Hodgdon, H., Kinniburgh, K., Gabowitz, D., & Blaustein, M. (2013). Development and implementation of trauma-informed programming in residential schools using the ARC framework. *Journal of Family Violence*, 27(8), 679–692. <https://doi.org/gf4h49>
- Kabat-Zinn, J. (2013). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. Bantam.
- Kim, S., Schneider, S., Kravitz, L., Mermier, C., & Burge, R. (2013). Mind-body practices for post-traumatic stress disorder. *Journal of Investigative Medicine*, 61(5), 827–834. <https://doi.org/f4zhmn>
- Kirlin, M. (2010). *Yoga as an adjunctive treatment for PTSD in Latina women: A review of the evidence and recommendations for implementation* [Master's thesis, Pacific University]. <https://pdfs.semanticscholar.org/ca16/ff3d81b84d487290c0c3e5fcd29479f6d09f.pdf>
- Lanius, R. A., Frewen, P. A., Tursich, M., Jetly, R., & McKinnon, M. C. (2015). Restoring large-scale brain networks in PTSD and related disorders: A proposal for neuroscientifically-informed treatment interventions. *European Journal of Psychotraumatology*, 6, Article 27313. <https://doi.org/d86h>
- Leitch, L. (2017). Action steps using ACEs and trauma-informed care: A resilience model. *Health Justice*, 5, Article 5. <https://doi.org/fmn8>
- Leitch, M., Vanslyke, J., & Allen, M. (2009). Somatic experiencing treatment with social service workers following hurricanes Katrina and Rita. *Social Work*, 54(1), 9–18. <https://doi.org/fxwccd>
- Leon, A. C., Davis, L. L., & Kraemer, H. C. (2011). The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research*, 45, 626–629. <https://doi.org/cmhgtj>
- Levine, P. (1997). *Waking the tiger: Healing trauma: The innate capacity to transform overwhelming experiences*. North Atlantic Books.
- Marchand, W. (2014). Neural mechanisms of mindfulness and meditation: Evidence from neuroimaging studies. *World Journal of Radiology*, 6, 471–479. <https://doi.org/gf5nfc>
- Mendelson, T., Greenberg, M., Dariotis, J., Feagans Gould, L., Rhodes, B., & Leaf, P. (2010). Feasibility and preliminary outcomes of a school-based mindfulness intervention for urban youth. *Journal of Abnormal Child Psychology*, 38, 985–994. <https://doi.org/bx6kh5>
- Mueser, K., & Taub, J. (2008). Trauma and PTSD among adolescents with severe emotional disorders involved in multiple service systems. *Psychiatric Services*, 59, 627–634. <https://doi.org/xfx65p>
- New Mexico Sentencing Commission. (2016). *Adverse childhood experiences in the New Mexico juvenile justice population*. <https://nmsc.unm.edu/reports/2016/adverse-childhood-experiences-in-the-new-mexico-juvenile-justice-population.pdf>
- Niroga Institute. (2010). *Alameda County Juvenile Justice Center Unit 6 transformative life skills (TLS) program June 2008–December 2009*. https://www.niroga.org/vp/research/acjic6_results2010.pdf

- Ogden, P., Minton, K., & Pain, C. (2006). *Trauma and the body: A sensorimotor approach to psychotherapy*. W. W. Norton.
- Price, M., Spinazzola, J., Musicaro, R., Turner J., Suvak, M., Emerson, D., & van der Kolk, B. (2017). Effectiveness of an extended yoga treatment for women with chronic posttraumatic stress disorder. *The Journal of Alternative and Complementary Medicine*, 23(4), 300–309. <https://doi.org/f94j99>
- Ramadoss, R., & Bose, B. (2010). Transformative life skills: Pilot studies of a yoga model for reducing perceived stress and improving self-control in vulnerable youth. *International Journal of Yoga Therapy*, 20, 73–78. <https://doi.org/fmpb>
- Rhodes, A., Spinazzola, J., & van der Kolk, B. (2016). Yoga for adult women with chronic PTSD: A long-term follow-up study. *The Journal of Alternative and Complementary Medicine*, 22(3), 189–196. <https://doi.org/f8fcc8>
- Seigel, D. (1999). *The developing mind*. Guilford Press.
- Seigel, D. (2007). *The mindful brain: Reflection and attunement in the cultivation of well-being*. W. W. Norton.
- Sibinga, E., Kerrigan, D., Stewart, M., Johnson, K., Magyari, T., & Ellen, J. (2011). Mindfulness-based stress reduction for urban youth. *The Journal of Alternative and Complementary Medicine*, 17(3), 213–218. <https://doi.org/cq7388>
- Spinazzola, J., Rhodes, A., Emerson, D., Earle, S., & Monroe, K. (2011). Application of yoga in residential treatment of traumatized youth. *Journal of the American Psychiatric Nurses Association*, 17(6), 431–444. <https://doi.org/c7mws8>
- Streeter, C., Gerbarg, P., Saper, R., Ciraul, D., & Brown, R. (2012). Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. *Medical Hypotheses*, 78(5), 571–579. <https://doi.org/ghhrb5>
- Substance Abuse and Mental Health Services Administration. (2015). *Trauma-informed care in behavioral health services*. https://store.samhsa.gov/product/Trauma-Informed-Care-in-Behavioral-Health-Services/SMA15-4420?referer=from_search_result
- Svātmārāma. (2002). *The Hatha yoga prādīpika* (B. D. Akers, Trans.). YogaVidya.com. <https://www.yogavidya.com/Yoga/HathaYogaPradipika.pdf>
- van der Kolk, B. (2003). Neurobiology of childhood trauma and abuse. *Child and Adolescent Psychiatric Clinics*, 12, 293–317. <https://doi.org/fhhqwg>
- van der Kolk B. (2006). Clinical implications of neuroscience research in PTSD. *Annals of the New York Academy of Sciences*, 1071, 277–293. <https://doi.org/cbfjhq>
- van der Kolk, B., Stone, L., West, J., Rhodes, A., Emerson, D., Suvak, M., & Spinazzola, J. (2014). Yoga as an adjunctive treatment for post-traumatic stress disorder: A randomized controlled trial. *Journal of Clinical Psychiatry*, 75(6), e559–e565. <https://doi.org/f59qnn>
- Warner, E., Spinazzola, J., Westcott, A., Gunn, C., & Hodgdon, H. (2014). The body can change the score: Empirical support for somatic regulation in the treatment of traumatized adolescents. *Journal Child Adolescent Trauma*, 7(4), 237–246. <https://doi.org/dz4t>