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Impact of a Yoga Intervention on Physical Activity, Self-Efficacy, and Motivation in Women with PTSD Symptoms

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Abstract

Background: Studies using yoga have demonstrated initial efficacy for treating symptoms across anxiety disorders, including posttraumatic stress disorder.
Objective: Understanding how interventions influence participants' physical activity and what determinants affect continued physical activity behavior change is important because maintenance of the behavior may be critical to continued mental health gains and symptom reduction.
Methods: This study investigated change in physical activity and possible psychological mechanisms of physical activity behavior change, including self-efficacy and regulatory motivation, in a randomized controlled trial of yoga for women with post-traumatic stress disorder symptoms ($n = 38$).
Results: Growth curve modeling results showed no significant changes in physical activity or self-efficacy for either group, whereas external motivation decreased significantly in the yoga group but not in the control group.
Conclusions: Investigators of future yoga interventions may want to focus on increasing self-efficacy and internal regulatory motivation, so that physical activity and resultant symptom relief can be maintained.

Introduction

Posttraumatic stress disorder (PTSD) affects approximately 7.7 million adults per year.[1,2] Although effective cognitive-behavioral therapies exist for PTSD,[3] there is a great deal of interest in exploring complementary and alternative therapies for this pernicious condition.[4] For example, recent research has demonstrated the beneficial effects of physical activity (PA) on mental health.[5–7] Various types of PA interventions, including aerobic exercise and strength and flexibility training, significantly decrease clinical symptoms of mood and anxiety disorders.[8–10] In addition, Manger and Motta's[11] aerobic exercise intervention for PTSD showed promising results for symptom management, including reductions in depression and anxiety symptoms.

Research investigating the benefits of PA on mental health has most commonly focused on aerobic forms of exercise but has recently expanded to include activities shown to improve flexibility and balance, such as yoga. Current evidence for yoga in the treatment of mental health disorders and underlying mechanisms is limited. Preliminary studies have shown promise for yoga as a treatment for depression, anxiety, eating disorders, and PTSD.[12–16] Hatha yoga, which incorporates breath control, physical postures, and meditation, has improved PTSD symptoms after just eight sessions.[17] Yoga may impart psychological benefits by increasing mindfulness[18] and improving emotion regulation,[19] although research into these mechanisms is preliminary.

Key considerations in using PA to treat mental health symptoms are the psychological mechanisms of adopting new PA behaviors. Social cognitive theory, a prominent theoretical framework used in PA research, proposes that various psychosocial constructs work together to modulate behavioral change.[20] For example, self-efficacy, the belief that one has the abilities needed to successfully engage in the actions necessary to meet a desired goal,[21] has been proposed as a psychological mechanism associated with the beneficial effects of PA on mental health.[22,23] This construct has also been postulated to have a reciprocal relationship with PA, as not only a determinant but also an outcome of the behavior.[23] Research has found that the effect of self-efficacy on PA is more prominent during the initiation

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stages of exercise adoption than during later, maintenance stages.[24,25] Therefore, self-efficacy may be particularly important when adopting a new PA behavior. Self-efficacy can be increased in many ways, including through mastery experiences, vicarious learning, and emotive experiences or affective states.[26,27]

Self-regulation, also called self-determination or motivation, is proposed by social cognitive theory[21] to be another psychological mechanism associated with PA. In self-determination theory,[28] behavioral regulation exists on a motivational continuum, moving from higher external motivation and lower internal motivation to lower external motivation with higher internal regulation. On this continuum, external regulation motivates behavior through the avoidance of negative outcomes or the pursuit of an external reward (e.g., exercising to win a prize). Introjected regulation motivates behavior through the internalization of outward forces (e.g., obligation). Further along the continuum are identified and integrated regulation, both internal forms of regulation; the first occurs through any value gained from the behavior (e.g., enjoyment), and the second occurs once a behavior has been accepted into an individual's values system. While both are driven by internal factors, integrated regulation is often considered the most intrinsic-like.[29] Research has shown that self-regulation has a strong effect on PA, even above and beyond that of self-efficacy.[30] In addition, PA intervention trials have demonstrated decreases in external motivation and increases in intrinsic motivation over time in those undergoing an intervention.[31]

Thus, participation in yoga may increase self-efficacy and intrinsic motivation, which may increase PA and, in turn, improve mental health symptoms. These relationships are likely reciprocal, with psychological mechanisms mediating engagement in PA while engagement in PA promotes those mechanisms. Understanding continued change in variables such as self-efficacy and self-determination during an intervention may inform research targeting PA maintenance, which is critical to continued mental health benefits following the intervention.

The current study focused on secondary data analysis from a randomized controlled trial of yoga for PTSD. The parent study found that yoga generally improved PTSD symptoms, particularly re-experiencing and hyperarousal, among yoga participants.[14] The purpose of the parent study[14] was to investigate the effect of the yoga intervention on PTSD symptoms and not necessarily to promote continued PA in participants. However, for the reasons outlined above, it is important to examine psychological mechanisms that may partly account for the beneficial effects of PA on mental health symptoms. Thus, the study hypotheses were that (1) compared with the assessment-only control participants, yoga participants would increase their leisure-time PA both during and after the intervention and (2) yoga participants would experience changes in their self-efficacy and motivational sources of self-regulation for exercise, consistent with previous literature on PA interventions. As yoga participants were taken through 12 classes, small step-by-step instruction may have fostered their mastery experience with the activity. In addition, participants were not regular yoga practitioners, creating an opportunity for vicarious learning, as group members watched each other successfully proceed through the intervention.

Materials and Methods

Participants

Participants were recruited *via* fliers at a large Northeastern Veterans Affairs hospital, Craigslist, or the National Center for PTSD research participant database. Inclusion criteria were age 18–65 years, female sex, and having at least subthreshold PTSD, as indicated by the presence of at least one symptom in each criterion ''cluster,'' or meeting criteria for at least two symptom clusters,[14,32] as measured by the PTSD Symptom Scale–Interview (PSS-I).[33] Participants who had taken a yoga class within the past 6 months, had a substance dependence problem in the past 3 months, had a recent change in psychiatric medication, or indicated a current suicide or homicide risk were excluded.

Eligible study candidates attended a baseline assessment session, including a diagnostic interview using the PSS-I and the Structured Clinical Interview for the DSM[34] and a battery of self-report instruments, including written questionnaires assessing PTSD symptoms, exercise self-efficacy, behavioral regulation of exercise, and exercise behaviors, as described below. Those reporting at least subthreshold PTSD during this appointment were randomly assigned to the yoga intervention group or the assessment-only control group. Participants were randomly assigned through the use of the Excel® random numbers function (Microsoft Corp., Redmond, WA).

Intervention

Yoga participants attended 75-minute yoga classes weekly for 12 weeks or twice weekly for 6 weeks, depending on the participant's preference. The intervention was designed by the principal investigator, a licensed psychologist, and the yoga instructor, who is certified in Kripalu yoga, which focuses on the mind–body connection, breathing, and physical postures. The curriculum incorporated elements of trauma-sensitive yoga[35] in that the instructor did not move around the room during class or offer physical assistance, the lights remained on, and ''invitational language'' was used to encourage participants to try poses but also to remind them that they could choose to do or not do a pose as they wished. The intervention began with simple poses that built upon one another over time. While physical postures were a primary focus of the intervention, the program also integrated the yoga principle of kindness to self, as well as skill components of Dialectical Behavior Therapy[36] (e.g., mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness) throughout the physical sequences. See Dick et al.[19] for a detailed description of the specific themes of the yoga intervention.

Once per week, yoga participants completed a brief packet of measures, including leisure-time PA. At the end of the intervention, they again completed all the questionnaires that had been administered at the baseline session (including the measures of self-efficacy and behavioral regulation). Participants completed all questionnaires once more at the 1-month follow-up assessment. Participants were encouraged but not required to practice on their own; they were given two handouts with poses to practice on their own.

The assessment-only control participants met weekly for 12 weeks in groups of approximately five people to complete the same weekly questionnaires as the yoga participants.

Control participants also completed all assessments at the end of the study period and 1-month follow-up. After the follow-up, they were offered 12 weekly sessions of yoga; no data were collected during the control participants' yoga classes.

Outcome Measures

Behavioral Regulation in Exercise Questionnaire–2 (BREQ-2). The BREQ-2, a 23-item measure of exercise motivation, is based on self-determination theory and assesses the degree to which the behavioral regulation to exercise is internally motivated versus externally motivated. The BREQ-2 has five subscales: amotivation, external motivation, introjected motivation, identified motivation, and intrinsic motivation. In the development sample for BREQ-2, Cronbach α values for the subscales ranged from 0.73 to 0.86, and developers reported that the measure demonstrated good construct validity.[37] In the current study, the Cronbach α value for subscales ranged from 0.69 to 0.92. Participants completed BREQ-2 at baseline, after the intervention, and at 1-month follow-up.

Godin Leisure-Time Exercise Questionnaire (GLTEQ). The GLTEQ assessed participants' weekly exercise behaviors other than the yoga class. It includes five items asking how often the respondent engaged in PA for each category of intensity: strenuous, moderate, and mild.[38] Total weekly leisure activity is calculated as follows: ([9 × strenuous workouts] + [5 × moderate workouts] + [3 × light workouts]). The 2-week test-retest reliability coefficients for this measure were 0.83 and 0.85 in the development study.[39] Participants in the current study completed this measure at baseline, weekly during the 12-week intervention period, after the intervention, and at 1-month follow-up.

Transtheoretical model measure of self-efficacy for exercise (SEE). This measure includes 18 items that measure self-efficacy with respect to exercise,[40] with response options ranging from 0 (not at all confident) to 4 (completely confident). The items were averaged to obtain the overall SEE scores. The measure's developers reported an internal consistency coefficient of 0.94.[40] In the current study, Cronbach α value for this measure was 0.97. The SEE was completed at baseline, after the intervention, and at 1-month follow-up.

Statistical analyses

Descriptive statistics were calculated using PASW Statistics software, version 18 (SPSS Inc., College Station, TX) and are shown as mean (M) ± standard deviation (SD). Growth curve models, using a multilevel framework to estimate change over time, were estimated using Mplus 6.0.[41] The full intention-to-treat sample ($n = 38$) was included in the analyses. A time variable was created on the basis of the number of days since the baseline session, which was coded as 0 because measurement time points were not equidistant. Slope means were examined to determine whether outcomes changed significantly over time.

The once-weekly yoga group participants completed 12 weekly assessments (including the GLTEQ), while the twice-weekly yoga group participants completed only 6 weekly assessments during the intervention. Thus, the once-weekly group's even-numbered assessments were excluded from the growth curve model for GLTEQ, including only baseline, session 1, session 3, session 5, session 7, session 9, session 11, post-intervention, and 1-month follow-up assessments. The BREQ-2 and SEE were assessed at three time points (baseline, post-intervention, and 1-month follow-up), which were all included in the growth curve models. Group (yoga or control) was included as a between-subjects variable in the models to determine whether group had a significant effect on change over time.

The formula β (time)/SD_{raw},[42] which produces a measure of effect size analogous to Cohen d, was used to calculate the effect of group assignment on outcomes. β is the regression coefficient for the slope on group, time is the mean number of days since baseline at the 1-month follow-up assessment, and SD_{raw} is the SD for the total sample at baseline.

Results

Participant characteristics

Of the 41 women who attended the baseline assessment session, 3 did not have at least subthreshold PTSD. The remaining 38 were deemed eligible for the study and were randomly assigned to the yoga group ($n = 20$) or the assessment-only control group ($n = 18$).

Participants' ages ranged from 20 to 65 years (M = 44.368 ± 12.374 years), and the majority (52.6%) were white. Nearly half (47.4%) of participants reported previously taking a yoga class. The average body mass index was in the overweight range (M = 29.334 ± 7.381; range, 19.51–48.83). Mean scores for the GLTEQ, SEE, and BREQ-2 are presented by group and time point in Table 1.

Completers versus non-completers

As reported previously,[14] no demographic differences were found between completers ($n = 26$) and non-completers ($n = 12$). Additionally, there were no differences in baseline scores between completers and non-completers on the GLTEQ, SEE, or BREQ-2–amotivation, external regulation, introjected regulation, or intrinsic regulation subscales (all $p > 0.05$). However, on the BREQ-2 subscale for identified regulation ($t = -2.785$; $p = 0.009$), study completers had significantly lower baseline scores than non-completers (completers, 8.000 ± 3.586; non-completers, 11.038 ± 2.391).

Growth curve models

Leisure-time PA scores (measured by the GLTEQ) decreased non-significantly over time, from baseline to the 1-month follow-up, in both groups combined (M = −0.013; $t = -0.300$; $p = 0.764$) and were not affected by group. When analyzed separately, the yoga group showed a non-significant increase in PA (M = 0.025; $t = 0.303$; $p = 0.762$), and the control group's PA decreased non-significantly ($M = -0.047$; $t = -1.372$; $p = 0.170$). Self-efficacy scores for exercise (measured by the SEE) did not significantly change over time in both groups combined (M = 0.001; $t = 0.509$; $p = 0.611$), and the effect of group on self-efficacy was not significant. When analyzed separately, neither group changed significantly in self-efficacy over time. Effect sizes for these models were 0.31 for the GLTEQ and 0.34 for the SEE.

Table 1. Outcomes by Group

	Yoga group (n = 20)			*Assessment-only control group (n = 18)*		
Measure	*Baseline*	*Post-yoga*	*1-month follow-up*	*Baseline*	*Post-12 sessions of assessment*	*1-month follow-up*
BREQ-2: Amotivation	2.00 ± 3.45	1.07 ± 1.82	1.00 ± 2.08	2.29 ± 2.54	0.82 ± 1.17	0.42 ± 1.00
BREQ-2: External regulation	2.79 ± 3.07	1.71 ± 1.68	1.46 ± 1.33	3.06 ± 3.56	4.00 ± 3.95	3.08 ± 3.87
BREQ-2: Introjected regulation	4.80 ± 3.25	3.57 ± 2.85	4.62 ± 3.31	5.06 ± 3.57	5.82 ± 4.51	4.50 ± 3.78
BREQ-2: Identified regulation	10.40 ± 3.47	9.64 ± 5.18	9.92 ± 4.79	10.39 ± 3.53	10.36 ± 2.50	10.67 ± 3.34
BREQ-2: Intrinsic motivation	7.89 ± 5.11	8.07 ± 5.36	9.91 ± 4.61	8.17 ± 5.01	8.27 ± 4.73	8.42 ± 4.56
GLTEQ	20.94 ± 24.98	24.86 ± 22.17	34.64 ± 27.15	25.44 ± 20.60	22.80 ± 17.13	25.60 ± 15.27
SEE	1.73 ± 1.21	1.43 ± 1.09	2.12 ± 1.28	1.35 ± 0.88	1.41 ± 0.71	1.72 ± 0.62

Values are expressed as mean ± standard deviation.
BREQ-2, Behavioral Regulation in Exercise Questionnaire–2; GLTEQ, Godin Leisure-Time Exercise Questionnaire; SEE, transtheoretical model measure of self-efficacy for exercise.

The study also examined change over time in each subscale of the BREQ-2. Amotivation decreased significantly in both groups combined ($M = -0.010$; $t = -2.718$; $p = 0.007$). The effect of group was not significant. When analyzed separately, the control group's amotivation scores decreased significantly ($M = -0.014$; $t = -3.37$; $p = 0.001$); however, the yoga group's scores did not change significantly ($M = -0.004$; $t = -1.367$; $p = 0.172$).

In the total sample, there were no significant changes in the other subscales of the BREQ-2. However, when analyzed separately, yoga participants showed a significant decrease in external regulation ($M = -0.011$; $t = -2.332$; $p = 0.020$), whereas the control group had no significant change ($M = 0.004$; $t = 0.538$; $p = 0.590$). Neither group had significant changes on any of the other subscales (results available from the last author upon request). Effect sizes for the BREQ-2 subscales were 0.31 for amotivation, 0.54 for external motivation, 0.28 for introjected motivation, 0.59 for identified motivation, and 0.29 for intrinsic motivation.

Discussion

Previous studies have investigated various modalities of PA, including yoga, as adjunctive mental health treatments, as well as the psychological mechanisms by which those activities are adopted and maintained.[12–16] The present investigation examined the effect of a yoga intervention on the growth trajectories of leisure-time PA behaviors, self-efficacy for exercise, and sources of exercise self-regulation, previously shown to be determinants of PA behaviors,[23,29] in women with PTSD symptoms.

For the hypothesis that yoga group participants would increase their leisure-time PA during the intervention, a trend was seen in the expected direction, but findings did not reach significance. Comparatively, this trend was not evidenced by the control group after the intervention. The second hypothesis was partially supported: that changes would occur in self-efficacy and motivational regulation for exercise, both constructs that have been associated with adoption and maintenance of PA. Although self-efficacy and some of the motivation subscales did not change significantly, the yoga group did evidence a significant decrease in external regulation. Thus, they may have begun to shift from exercising for external reasons (e.g., for the research study alone) to internally motivated reasons.

Interestingly, the control group's amotivation scores decreased significantly during the study. These participants may have been planning to participate in yoga classes after all data were collected, and anticipation of this regular exercise may have increased their motivation levels.

When asked about practicing yoga at home, many yoga group members expressed concern about being able to practice alone. Perhaps their self-efficacy did not increase because they believed they would not be able to engage in yoga or other exercise without instruction. While previous research has shown that increased self-efficacy and internal motivation are associated with the adoption and maintenance of PA, these trials have primarily used relatively easy aerobic exercises. Researchers designing yoga interventions, particularly with participants who have little previous exposure to the activity, may need to focus on developing self-efficacy and internal motivation, perhaps through mastery experiences, instructor reinforcements, or increased education. Attention to these constructs may be particularly important for participants with PTSD, who may have had an experience of physical helplessness, decreasing their overall self-efficacy and internal locus of control. While our results offer some evidence that a yoga intervention may help improve exercise motivation in women with PTSD, most of the effects detected were relatively small. Further, power analyses indicated that the study had <10% power to detect medium effect sizes.

It is likely that given a larger sample size, changes in relevant constructs would be more easily detected, particularly in those that trended in expected directions. In addition, the purpose of the parent study[14] was to investigate the effect of the yoga intervention on PTSD symptoms and not necessarily to promote continued PA in participants. However, because the treatment was engagement in the practice of yoga, continued therapeutic gains through maintained yoga practice or other physical activities would likely have been encouraged. In addition, the present trial focused on women with subthreshold or full PTSD, limiting its generalizability to men or to other mental health populations.

Because the beneficial effects of aerobic PA as an adjunctive therapy for mental health difficulties have already been demonstrated, continued research should seek to uncover the utility of other forms of activity (e.g., flexibility and strength training). Understanding psychological determinants

affected by PA interventions such as yoga and promoting continued engagement in PA could facilitate maintenance of the activity and prolong symptom reduction. In light of the current findings and previous results demonstrating increased self-efficacy and self-regulation with increased engagement in PA,[26,27,29] future research to better understand the growth of these constructs during and after a yoga intervention may be useful for developing more targeted interventions in patients with mental health disorders.

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Author Disclosure Statement

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