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Original Research

Consistency Over Intensity: The Mental Health Benefits of an 8-Week Hatha Yoga Intervention for Women

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Abstract

International Journal of Exercise Science 19(3): 3003, 2026. Women report more psychological stress and are more likely to be diagnosed with depression or an anxiety disorder compared to men. Previous research demonstrates that yoga can improve aspects of mental health; however, few studies document the yoga class structure, track attendance, and/or measure physical activity levels. Moreover, few studies have evaluated whether these factors are associated with mental health outcomes. This study addressed limitations of previous research by implementing a consistent Hatha yoga class structure, measuring physical activity during each session, tracking attendance, and examining changes in self-reported depression, anxiety, and stress for women. Fourteen women, ages 25-55, completed the Depression, Anxiety and Stress Scale-21 (DASS-21)[1] before and after an 8-week Hatha yoga intervention. A consistent class structure was implemented throughout the intervention and physical activity was measured via accelerometry during each class. The 8-week Hatha yoga intervention resulted in significant decreases in anxiety and stress. Participants spent most of the class time at a sedentary activity level, indicating that moderate-to-vigorous levels of physical activity during Hatha yoga are not necessary for improvements in anxiety and stress. Last, participants who attended approximately 14 of the 16 sessions were likely to see improvements in depression, stress, and anxiety. These findings highlight the importance of emphasizing attendance and a consistent class structure in yoga-based mental health interventions. Future research should focus on optimizing yoga dosage for psychological well-being.

Keywords*:* Female mental health, mind-body intervention, complementary therapy

Introduction

Yoga is recognized as an effective physical activity and fitness practice[2,3] that encompasses a variety of physical, mental, moral, and spiritual practices that promote overall health, well-being, and heightened awareness.[4] While there are many paths of yoga, most Western yoga classes focus on Hatha yoga, which includes physical postures (asanas), breathing exercises (pranayama), relaxation, and sometimes meditation techniques.[5] Hatha yoga is practiced at a slower pace, making it accessible to beginners, and classes typically involve breath work, physical postures, prolonged maintenance of poses, and continuous, non-judgmental attention during practice.[6]

In recent years, several systematic reviews and meta-analyses have evaluated the efficacy of yoga as a complementary and integrated health approach to treat depression[7-10] and anxiety[9,11] disorders. Notably, Wu and colleagues (2023) report that yoga has a moderate effect on depressive

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symptoms and a small effect on anxiety levels. Martinez-Calderon et al. (2023) reached a similar conclusion, reporting that yoga-based interventions reduced anxiety symptoms in people with anxiety disorders and decreased depression symptoms in people with depression. A common barrier to drawing conclusions across studies reported by systematic reviews and meta-analyses is the lack of consistency when reporting yoga style, class design, and the intensity of the physical activity experienced by the participants.[7-10] Without consistent reporting of these components, it is difficult to ascribe improvements in mental health to any one aspect of the intervention.

Participation in physical activity is associated with positive outcomes in mental health.[12-16] Previous work demonstrates that Hatha yoga can help meet physical activity guidelines, and it is predominately performed at a moderate level.[17] However, the amount and intensity of physical activity accumulated during yoga interventions are rarely objectively quantified, and class structure is inconsistently described across studies. As a result, it remains unclear how much physical activity participants perform during yoga practice and how this exposure varies across sessions. Furthermore, there are conflicting reports on the influence of exercise intensity on anxiety, depression, and stress.[18-21] Some research suggests that participating in light intensity physical activity results in favorable mental health outcomes because it may be a more enjoyable form of physical activity for people beginning an active lifestyle,[18] increase long-term commitments to physical activity,[18] lower depression symptoms,[22,23] and lower risk of psychological distress.[24] On the other hand, some research suggests that moderate-to-vigorous physical activity (MVPA) may yield stronger effects for mental health due to an increase in brain-derived neurotropic factor,[21] reducing psychological distress,[20] improving overall mental health,[20] and reducing anxiety.[19] A lack of consistency across the existing work evaluating the effects of yoga on stress, depression, and anxiety is due, in part, to a lack of reporting the amount and intensity of physical activity performed during yoga practice.[9-11,25]

Therefore, the goal of the present study was to address the limitations of previous research by utilizing a consistent class structure in a 60-minute Hatha yoga session, measuring the amount and intensity of physical activity experienced by each participant in each session, and tracking attendance. The class structure was pre-determined by the study team and communicated to the yoga instructor. These discussions included determining physical postures, breathing exercises, relaxation, and meditation techniques. Additionally, the goal of the present study was to investigate the effects of an 8-week Hatha yoga intervention on self-reported depression, anxiety, and stress. As previous literature reports that depression and anxiety disorders are more common in women compared to men,[26-29] the current study focuses on women ages 25-55. We hypothesize that self-reported symptoms of depression, anxiety, and stress will be reduced post-intervention and that reductions will be related to the number of yoga sessions attended.

Methods

Participants

Participants were recruited from the Lee County area through flyers and social media. Participants expressed interest in the study and were screened by phone for eligibility. To participate, volunteers had to be women ages 25-55, not participating in yoga more than two times a week over the past three months, and at a low risk for medical complications from exercise as determined by the Physical Activity Readiness Questionnaire.[30] Exercise interventions show small-to-medium effect sizes for reductions in depression (-.43) and anxiety (-.42).[31] An *a priori* sample size calculation completed with G power suggested a sample size of 36 participants with an effect size of .42, alpha

level of .05 and power of .80. All study procedures were in accordance with the Declaration of Helsinki and approved by the Auburn University Institutional Review Board, protocol number: 23-408 EP 2308. All participants signed a written informed consent before the start of the study. Figure 1 displays the participant flow diagram.

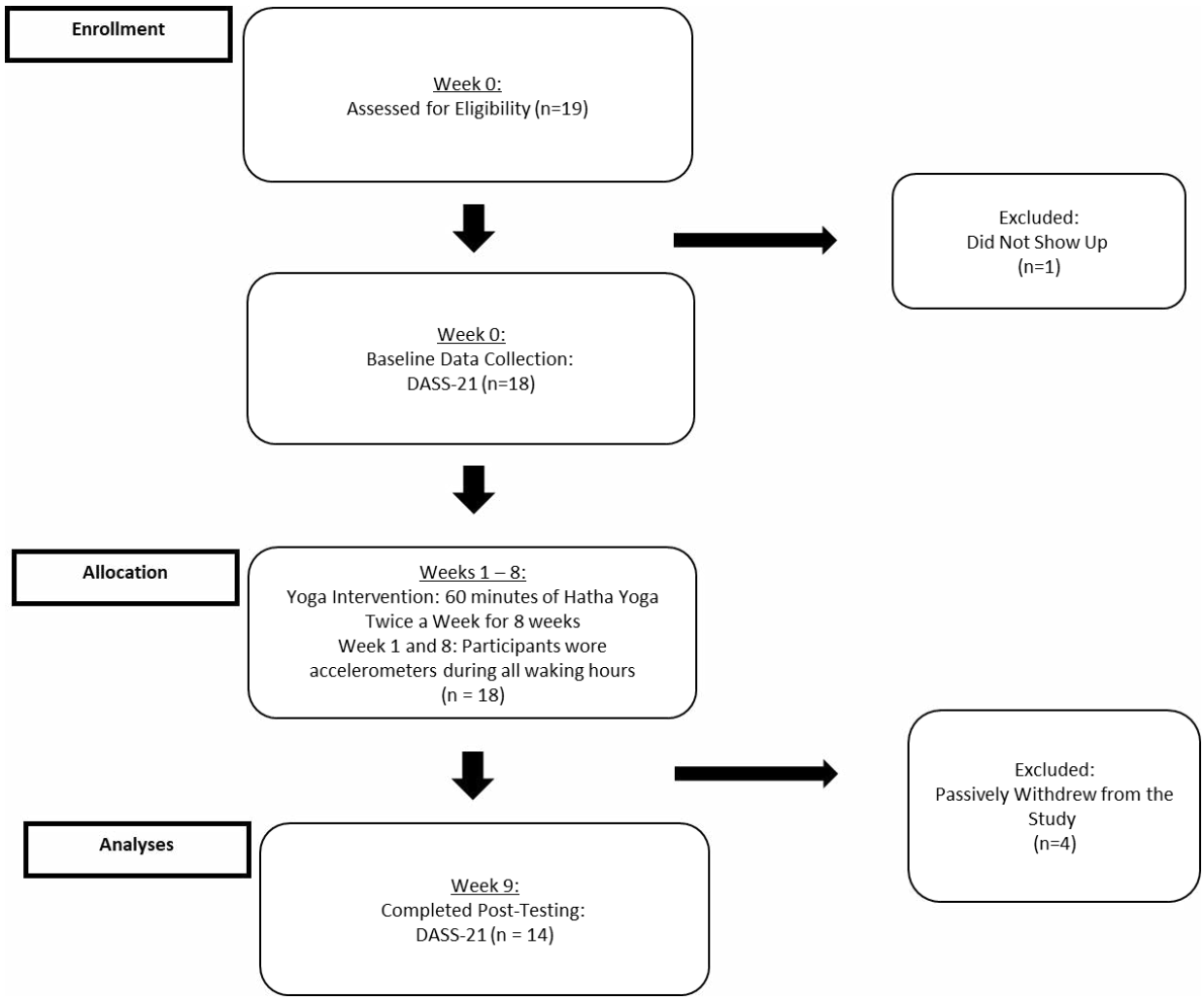


Figure 1. CONSORT Flowchart of Participants.

Protocol

All participants completed an in-person pre-test and post-test session at a university laboratory. The pre-test was conducted within six days prior to the first yoga session. The post-test was conducted within seven days following the final yoga session, except for one participant who delayed her post-test to 22 days after the last day of the intervention due to infection with coronavirus (i.e., COVID-19). At each testing session, participants completed Qualtrics-based questionnaires using a laptop. Participants completed a demographics questionnaire including date of birth, race, hand dominance, and smoking status, as well as the Depression, Anxiety, and Stress Scale (DASS-21)[1]. The DASS-21 is a 21-item questionnaire to assess symptoms of depression, anxiety, and stress[1]. Each of the 21 items is scored on a scale from 0 to 3. Questions for each subscale are summed and multiplied by two to create a score for each subscale (range: 0-42), higher scores indicate greater symptoms of depression, anxiety, and stress.

As shown in the participant flow diagram in Figure 1, participants completed an in-person Hatha yoga session twice a week for 60 minutes per session, for eight weeks, for a potential total dose of 960 minutes. Hatha yoga sessions were conducted in an exercise room within a university laboratory. Attendance was recorded, and objective physical activity intensity was recorded by accelerometers (Actigraph GTX3; Pensacola, FL, USA) worn by each participant on their non-dominant wrist at each yoga session. If a participant arrived late or left early, the exact duration the accelerometer was worn was recorded. The average wear time across all 16 sessions was 60.59 SD 2.02 minutes. This method provides continuous, standardized physical activity intensity data across all sessions and participants, regardless of individual pose adaptations. Logs were kept to document time on and off, to allow for wear-time adjustments. Absent participants were provided with a link to a Zoom recording of the yoga session, but they were marked as absent for the in-person session as we could not monitor participation and levels of physical activity.

Each session was led by a 500-hour registered yoga teacher and consisted of traditional Hatha yoga poses. The same instructor was contracted to lead all 16 class sessions. The instructor was not part of the research team and did not have access to study data. The same format of class was used in each session, although different postures may have been used. Each session included 5-10 minutes of intention and breathing, 40 minutes of postures, which focused on balance, strength, and flexibility, and 5-10 minutes of Savasana. A sample class is shown in Table 1. Over the course of the intervention, the sessions incorporated progressions to more challenging poses. Participants had access to appropriate props such as blocks, straps, and bolsters. Any modifications or progressions to the yoga poses in the proposed flow were determined by the participants, their progress, and the yoga instructor. The participants were not compensated for their participation.

Table 1. Standard Hatha Yoga Class Format Used in the Intervention.

Introduction (10 minutes)
- Opening intention setting
  - Yamas
  - Niyamas
- Breathing
  - 3-part breath
  - Belly breathing
- Opening sequence
  - Range of motion to awakening the body to movement. Typically, 1-3 exercises that targeted the shoulders, hips, and spine.

Warm-up (10 minutes)
- Modified Sun Salutations
- Transition to standing postures

Standing Postures (20 minutes)
- Standing postures that focused on mobility, flexibility, strength, and postural control.
- Examples throughout the intervention included: Warrior I, Warrior II, Triangle, Side angle, and pyramid.

Balance Postures (5 minutes)
- Postures focused on standing balance.
- Examples throughout the intervention included: Tree, Warrior III, and Standing pigeon.

Floor Postures (10 minutes)
- Transition to floor using modified sun salutations.
- A variety of postures to improve flexibility.
- Examples throughout the intervention included: seated forward fold, spinal twist, pigeon, happy baby.

Final Relaxation (5 minutes)
- Transition to Savasana
- Savasana (Corpse Pose)

Statistical Analysis

All physical activity data were downloaded and analyzed in ActiLife 6 (Version 6.13.4) and calibrated based on participants' characteristics. Cut points in 60-second epochs were used to categorize activity into sedentary behavior, light, or MVPA.[32] Data for the intensity of exercise recorded by the accelerometers was first downloaded and analyzed in ActiLife 6. The number of minutes and percentage of time spent in sedentary behavior, light PA, and MVPA were calculated for each yoga session. In addition, time spent in sedentary, light PA, and MVPA was calculated for each segment of each class: introduction, warm-up, standing postures, balance postures, floor postures, and final relaxation.

Statistical analysis for the obtained data was performed using IBM Statistical Package for the Social Sciences (Version 29). To examine changes in depression, anxiety, and stress, planned comparisons were conducted between pre- and post- test scores on the DASS-21. To determine the impact of attendance on the change in depression, anxiety, and stress, a logistic regression was conducted in which the subscale scores served as the dependent variable and the number of exercise sessions attended served as the independent variable. An alpha level of .05 was used for all statistical tests.

Results

As shown in Figure 1, 19 participants were screened by phone for eligibility, and five participants passively withdrew from the study. As a result, 14 participants were included in the final analysis. Table 2 reports the demographic information for participants who completed the pre- and post-test sessions.

Table 2. Demographic Characteristics of Participants at Pre- and Post-test.

	PRE (n=17)	**POST (n=14)**
Age (Years)	40.7 (SD= 10.3)	42.5 (SD= 10.18)
BMI	30.6 (SD=7.4)	29.0 (SD= 5.0)
RACE		
White	14	12
Black	1	0
American Indian/ Alaskan Native	1	1
Other	1	1

Table 3 reports the frequencies for severity level for each subscale of the DASS-21, pre- and post-intervention. Table 4 reports the planned comparisons for pre- and post-test differences in depression, anxiety, and stress as reported in the DASS-21. The results reveal a significant improvement in anxiety ($p = .025$, $d = .68$) and stress ($p = .009$, $d = .73$), with medium effect size as calculated by Cohen's d. Although an improvement in depression was observed, the comparison failed to reach traditional levels of significance, and the effect size was small ($p = .104$, $d = 0.47$).

Accelerometer data demonstrated that, on average, participants spent 43.01 SD 4.7 minutes in sedentary activity, 12.93 SD 3.41 minutes in light activity, and 3.26 SD 1.41 minutes in MVPA during the yoga sessions. Figure 2a displays the average number of minutes participants spent in sedentary, light PA, and MVPA during the 60-minute yoga sessions. Class duration was standardized across all weeks; therefore, minutes provide a consistent measure of overall intensity distribution. Figure 2b shows the percentage of time spent in each intensity category within each class segment. Percentages were used in Figure 2b because segment durations (e.g., breathing, warm-up, asanas) varied slightly across sessions; expressing intensity as a percentage standardizes these differences and allows for comparison across segments.

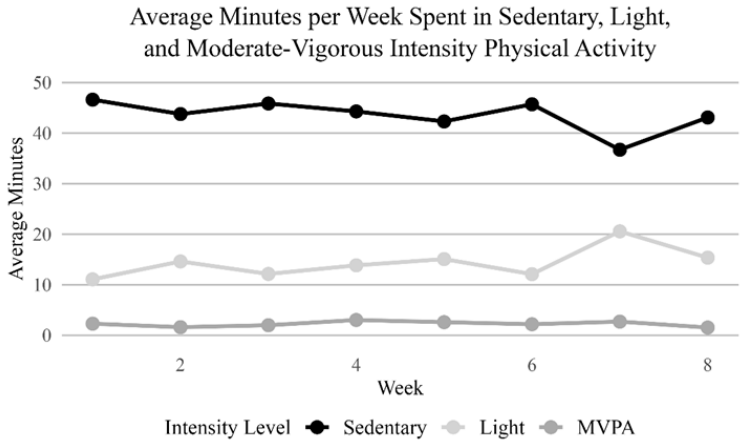
Table 3. Frequency Table for Severity Levels on the DASS-21 Subscales at Pre- and Post-test.

	Depression		**Anxiety**		**Stress**	
Severity level	***Pre (n = 14)***	***Post (n = 14)***	***Pre (n = 14)***	***Post (n = 14)***	***Pre (n = 14)***	***Post (n = 14)***
Normal	0	0	0	0	1	2
Mild	0	0	0	0	1	3
Moderate	11	11	3	3	4	2
Severe	2	2	3	8	5	7
Extremely severe	1	1	8	3	3	0

Table 4. Descriptive Statistics and Group Differences for Study Variables.

	Pre-test	**Post-test**	**Group differences**	**Effect size**	**95% CI (Lower)**	**95% CI (Upper)**
Depression	18.9 (3.8)	17.7 (4.3)	$t(13) = 1.75$, p = .104	d = 0.47, small effect	-0.058	1.167
Anxiety	21.1 (5.5)	17.6 (3.6)	$t(13) = 2.53$, p = .025*	d =0.68, medium effect	0.152	1.450
Stress	27.0 (7.1)	23.0 (6.6)	$t(13) = 2.73$, p = .009*	d = 0.73, medium effect	0.204	1.524

Note. Pre- and post-test values represent the mean and standard deviation (in parentheses) for the 14 participants that completed both pre- and post- test sessions. Asterisks note significant differences at alpha = .05.



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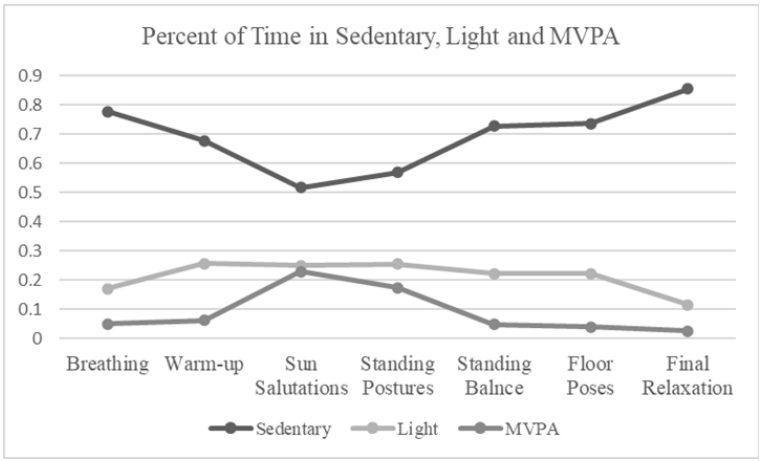

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Figure 2. A) Average Minutes per Week spent in Sedentary, Light, and Moderate-Vigorous Intensity Physical Activity During Yoga. B) Percent of Time Spent in Sedentary Activity, Light Activity, and Moderate to Vigorous Activity for Each Segment of the Class Session.

The results for attendance, reported in Figure 3, show that the average attendance was 13.5 SD 1.83 sessions. A logistic regression determined the relationship between the number of yoga sessions attended (out of 16) and changes in depression, anxiety, and stress scores. Participants' changes in subscale scores on the DASS-21 served as the dependent variable, and the number of exercise sessions attended served as the independent variable.

Changes on the DASS-21 showed that eight participants decreased their stress scores and six participants increased their stress scores from pre-test to post-test. Participants whose DASS-21 scores reflect a decrease in stress averaged 13.8±1.03 sessions, and participants that increased stress averaged 9.25±4.39 sessions. For stress, the omnibus test of model coefficients showed a significant model (p = .004). The Hosmer and Lemeshow test showed a significance of .012, indicating that the model fits the data and supports further interpretation. This model was observed to be accurate, 88.9%, and the odds of showing a decrease in stress at post-intervention increased by .602 for each additional session.

Changes on the DASS-21 showed that six participants reduced anxiety, and eight participants increased anxiety. Participants whose DASS-21 scores reflect a decrease in anxiety averaged 14.12±1.80 sessions, and participants that increased anxiety averaged 9.90±3.87 sessions. For anxiety, the omnibus test of model coefficients showed a significant model (p = .004). The Hosmer and Lemeshow test showed a significance of .425, indicating that the model fits the data and supports further interpretation. This model was observed to be accurate, 77.8%, and the odds of showing a decrease in stress at post-intervention increased by .550 for each additional session.

Changes on the DASS-21 showed that five participants decreased depressive symptoms, and nine participants increased depressive symptoms. Participants whose DASS-21 scores reflect a decrease in depression symptoms averaged 14.0±1.00 sessions and participants that increased depressive symptoms averaged 10.36±4.18 sessions. For depression, the omnibus test of model coefficients showed a significant model (p = .019). The Hosmer and Lemeshow test showed a significance of .530, indicating that the model fits the data and supports further interpretation. This model was observed to be accurate, 72.2%, and the odds of showing a decrease in stress at post-intervention increased by .632 for each additional session.

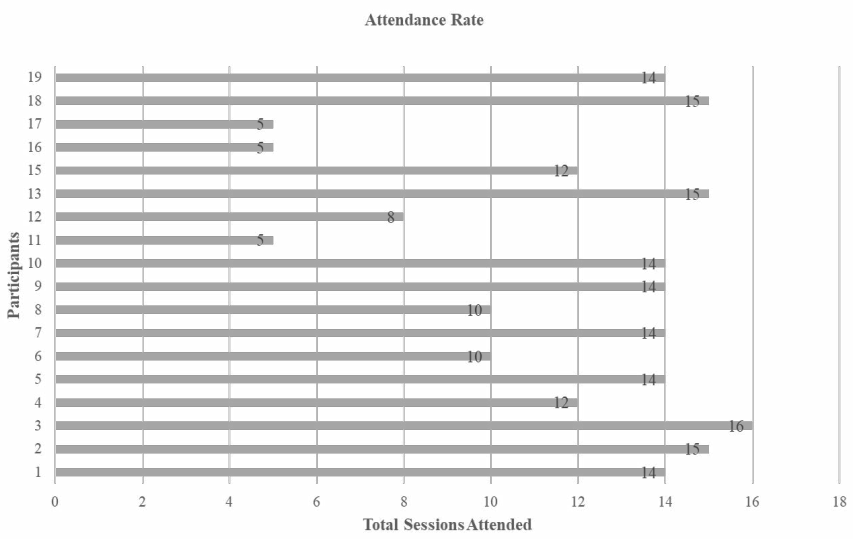

Figure 3. Attendance Rate for Each Participant for the Duration of the 8-week Intervention.

Discussion

The results demonstrate three important findings. First, the 8-week Hatha yoga intervention resulted in significant decreases in anxiety and stress scores as measured by the DASS-21 1. Second, during the 16 hatha yoga classes delivered over 8 weeks, participants spent on average 71.55% of class time in sedentary behavior, 21.55% in light intesnity PA, and 5.43% in MVPA. Third, participants who attended 14 of the 16 sessions were likely to see improvements in depression, stress, and anxiety.

Our study aligns with previous reports that Hatha yoga is an effective intervention for improving stress and anxiety.[33] Yoga may help reduce anxiety and stress by enhancing executive function and overall cognitive functioning.[33] During our yoga sessions, participants were encouraged to focus on their breath, sensations in the environment, and their thoughts. Consistent practice of this focus may improve the ability to suppress unwanted distractions in the mind and environments, as well as shifting focus to desired thoughts.[33] Improved self-regulation by improved inhibition and shifting abilities may aid in alleviating stress and anxiety.[33] Our yoga sessions focused on self-regulatory processes through the incorporation of the Yamas (moral observations), Niyamas (self-disciplines), breath regulation, and meditation.[34] These strategies were integrated throughout the class and were encouraged by ongoing instructor-led verbal cues. The combination of physical activity and cued self-regulatory practices may have contributed to the observed changes in anxiety and stress.

Although, on average, depression improved post-intervention, these results were not significant, which contrasts with previous literature[8,10,22]. Furthermore, as shown in Table 3, participants who had moderate, severe, or extremely severe depression based on the DASS-21 remained at those levels post-intervention. In other words, although participants' subscale scores may have improved as a group, no participants moved to a less severe category on the DASS-21. A review examining the impact of yoga interventions on depressive symptoms found a small effect when compared to passive but not active controls.[35] The review noted that higher doses, frequency, and longer durations of yoga practice were associated with changes in depressive symptoms.[35] Therefore, the dose of our intervention may have been insufficient to reduce depression.[11]

Accelerometer data demonstrated that, on average, participants spent around 43 mins in sedentary behavior, 13 minutes in light physical activity, and 3 minutes in MVPA during the 60-minute sessions. As shown in Figure 2b, most of the sedentary time was spent at the beginning and end of the class, during breath work, warm-up, and final relaxation. Breath work (pranayama) and relaxation are a vital part of yoga practice and contribute to improvements in mental health.[36,37] The majority of MVPA occurred during sun salutations, standing postures, and standing balance. There are a few previous studies that evaluate the time spent in sedentary, light, and MVPA during Hatha yoga. Most previous studies utilize energy expenditure to classify the metabolic equivalent (MET) value of yoga, and estimates show that Hatha yoga on average is equal to 2.5 METS, or light physical activity, with sun salutations exerting higher MET values.[17,38]

There is no consensus in the literature as to the most effective intensity of exercise to improve depression, anxiety, and stress. A recent review reported that all physical activity, regardless of intensity, was effective at improving mental health, but moderate-to-vigorous intensity exercise was more effective at improving mental health compared to light intensity physical activity[31]. Additional data show that higher forms of exercise intensity, such as high intensity interval training, lead to improvements in depression and stress compared to a sedentary population.[40]

However, other research indicates that light-intensity physical activity is associated with positive mental health outcomes, as it may be more enjoyable for individuals initiating an active lifestyle, promote long-term adherence to physical activity,[18] reduce depressive symptoms,[22,23] and lower the risk of psychological distress.[24] Overall, our data show that participating in Hatha yoga twice per week contributes to weekly time spent in light and MVPA and improves anxiety and stress. Our data also show that sedentary time during yoga practice is valuable for reducing stress and anxiety in women.

Regression analyses indicated that the degree to which Hatha yoga influenced changes in stress and anxiety was dependent on session attendance. Participants who showed positive changes in stress and anxiety attended approximately 14 sessions. In comparison, participants who did not show positive changes in stress and anxiety attended approximately nine sessions. More research is necessary to identify the dose-response relationship between Hatha yoga and sustained changes in anxiety, stress, and depression.

Eighteen participants were recruited for the intervention; however, only 14 participants completed the intervention and post-testing session. This sample size is consistent with much of the extant yoga literature. The sample size may have reduced our ability to detect statistically significant changes for effects smaller than Cohen's d = 0.42, which was used in our *a priori* power analysis. Although larger sample sizes are always preferable to enhance statistical power and external validity, the observation of a medium to large effect size in a within-subjects design, with only 14 participants, is notable. This suggests that the effects are sufficiently robust to emerge even in a relatively small sample. Future studies seeking to replicate and extend these results should plan to recruit approximately 25 participants to account for potential attrition and to ensure adequate statistical power. Although accelerometers have limitations in detecting static activity (e.g., during sustained poses), they remain the most practical and objective tool for assessing movement-based intensity during yoga. Importantly, incorporating accelerometry addresses a research gap, as few yoga intervention studies have used objective measures of physical activity intensity when evaluating psychological outcomes. Further, we did not assess habitual physical activity levels prior to enrollment, which may have influenced baseline mental health status. Future research might consider evaluating or controlling baseline activity levels to determine whether pre-existing exercise behavior moderates the psychological effects of yoga.

Participation in an 8-week Hatha yoga intervention significantly improved self-reported stress and anxiety as measured by the DASS-21 for middle-aged women. Hatha yoga should be considered as a complementary medicine for reducing anxiety and stress for women. Future research should document the class style, format, and physical activity levels during the class to best determine what dose of Hatha yoga is effective at reducing depression, anxiety, and stress for women. Further, it remains unknown how long the positive changes in depression, anxiety, and stress are maintained.

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