**Cognitive and psychosocial effects of an acute sun salutation intervention among adults
with stress**

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Abstract

Evidence suggests that yoga can improve executive functioning (EF) and psychological well-being, but there is no evidence whether flow-based, moderate-intensity forms of yoga can deliver similar benefits. The purpose of this randomized controlled trial was to test the aforementioned effects of engaging in a 30-minute, video-guided sun salutation exercise ($n = 25$), relative to aerobic exercise ($n = 22$) and attentional control ($n = 24$). Low-active participants ($M_{age} = 27.84$; 87.3% female) completed psychosocial assessments and tasks assessing EF, before and after the session. Results showed a significant group difference for state anxiety ($p = .01$, $\eta_p^2 = .13$) and stress ($p < .05$, $\eta_p^2 = .09$), in favor of the yoga group. No significant between-groups differences in EF were observed. Results suggest that video-guided, flow-based forms of yoga can induce immediate improvements in well-being, yet extended involvement may be required to realize performance improvements in memory and processing speed.

The prevalence of yoga has increased among adults in Western societies, as a complementary form of exercise (Wang, Li, Choudhury, & Gaylord, 2019). Common reasons for practicing yoga include wellness or disease prevention (78.4%) and 6.4% practiced it specifically for stress reduction. The most common source of yoga information has been reported to be yoga classes (51.2%), followed by DVDs or CDs (36.5%), the internet (26.9%) and print media (24.3%) (Cramer et al., 2016). Also, over 120 mobile applications promote and support the practice of yoga (Cummiskey, 2011; García-Holgado, Reiris, Kearney, Martinus, & García-Peñalvo, 2019; Smith et al., 2016; Thirumalai et al., 2018). Given the market supply and demand, it is imperative to develop digital yoga interventions in accordance with the available scientific evidence, and sound psychological, pedagogical and usability principles.

Hatha yoga is popular in North America and Europe. It includes maintaining postures in isometric contraction while standing, sitting, or lying down, coupled with breathing and meditation exercises. Hatha yoga is an umbrella term that includes aspects from different styles of yoga varying in their speed, difficulty of postures, type of movement, and other elements of yoga practice (Morone & Greco, 2007). Most styles incorporate postures, breathing and meditation in some way (Mehta & Sharma, 2011). Some yoga styles focus on moderate cardiovascular intensity and coordination and are suitable for beginners. These include sun salutations and flow-based movements found in Vinyasa yoga. During the practice of sun salutations, the focus is on flow and transitions between movements rather than holding poses (see Figure 1). Sun salutations are usually performed at a fast pace and they require large body movements while synchronizing breath with each movement. There is growing evidence of yoga styles performed at moderate intensity tend to demand more cardiovascular activity than hatha

(low intensity) yoga. A 60-minute Vinyasa sequence has yielded an average heart rate of 109 beats per minute, a high rating of perceived exertion ($M = 13.7$) on the Borg Rating Scale, and an average of 273 kcals (i.e., 3.6 MET; Sherman et al., 2017).

Acute and long-term yoga interventions have reduced stress and anxiety. In a four-week intervention consisting of sun salutations, anxiety symptoms diminished after daily engagement for six minutes, as compared to the control group (Sakuma et al., 2012). Acute studies (sessions ranging from 15 to 90 minutes) have shown similar reductions in self-reported stress and anxiety, as compared to an attentional or true control group (Benvenuti et al., 2017; Huang, Chien, & Chung, 2013; Melville, Chang, Colagiuri, Marshall, & Cheema, 2012; Szabo, Nikhazy, Tihanyi, & Boros, 2017) or an active control group (Fishman et al., 2019; Marshall, Mcclanahan, Warren, Rogers, & Ballmann, 2020; Winroth, Hassmen, & Stevens, 2019). There are far fewer acute studies testing cognitive benefits of yoga, yet they have generally shown a positive effect on memory and EF (Gothe & McAuley, 2015), although the populations varied. Cognitive functions like memory and attention may deteriorate due to a high level of stress (Wolf, 2003). Indeed, one of the mechanisms through which yoga may improve EF is stress reduction (Gothe, Keswani, & McAuley, 2016). Thus, it is important to assess the relationship between yoga and cognitive functioning among individuals with stress.

Yoga research conducted so far has primarily investigated low intensity yoga sessions focused on Hatha yoga, lasting an average of 60 minutes. There is growing consensus among researchers regarding the need for exploring the effects of different styles of yoga (Cowen & Adams, 2007; Larkey, Jahnke, Etnier, & Gonzalez, 2009; Riley & Park, 2015; Ross & Thomas, 2010). Generally, the physiological effects of yoga differ by style. In an RCT comparing Hatha yoga to Ashtanga yoga among young adults, both groups improved in trunk strength and

flexibility, but the Ashtanga group improved in perceived stress and diastolic blood pressure as well (Cowen & Adams, 2005). Hatha yoga elicited a percent maximum heart rate of 45% whereas Ashtanga yoga was 54%. Schmalzl et al (2015) highlighted that few studies examine the contribution of the individual components of yoga, and that “investigations in which the type, amount or intensity of either movement, breath or attention are carefully manipulated, while the other components are kept constant,” (p. 240) will underscore the unique contribution of different yoga components.

Engaging in a moderate intensity or flow-based form of yoga may offer additional health benefits, such as reduced stress and blood pressure (Cowen & Adams, 2005), as compared to low-intensity yoga. In comparative studies, moderate intensity activity may be more beneficial to aspects of EF than low intensity activity (Kamijo et al., 2004; Lambourne & Tomporowski, 2010; Loprinzi & Kane, 2015; Wohlwend, Olsen, Håberg, & Palmer, 2017). However, there is a lack of evidence of the benefits of moderate intensity styles of yoga, in terms of their effect on psychosocial and cognitive functioning, as well as their feasibility and acceptability. These styles of yoga may enhance EF through the meta-cognitive rehearsal of postural sequences, coordination of breath with movement, and increased blood flow through dynamic movements. Further, psychosocial functioning may be enhanced via mind-body coordinated aerobic activity and centered, relaxed breathing.

The purpose of the present study was to examine the feasibility and acceptance of learning and engaging in sun salutations, and its acute effect on stress, anxiety, and EF. We hypothesized that the yoga group would perform better on tasks of EF and show lower stress and anxiety post-intervention, and enjoy the intervention, as compared to both aerobic exercise group and attentional control group.

Method

Participants

Seventy-one participants, between the ages of 18 and 45 years ($M = 27.84$, $SD = 8.85$), were recruited from a mid-Western university community. Participants were low-active (less than three times per week for 30 minutes), had not participated in mind-body activities in the past three months, and reported being free from any exclusionary conditions listed on the *PA Readiness Questionnaire* (Chisholm, Collis, Kulak, Davenport, & Gruber, 1975). Additionally, participants were only included if they reported three or more symptoms from the checklist for Generalized Anxiety Disorder from the *Diagnostic and Statistical Manual VI*. The study was approved by the Institutional Review Board of XXXXXXXX (IRB # 20067), and pre-registered on ClinicalTrials.gov. See figure 2 for study CONSORT.

Procedure

Participants wore a Fitbit Charge 3 (provided by us) for a seven-day period, for 24 hours each day to track their baseline PA. After one week, participants visited the laboratory for a two-hour appointment. They were randomly assigned to one of three groups. All participants completed psychosocial and cognitive assessments (40 minutes, in that order) before and after the 30-minute intervention. Participants in the yoga group completed a semi-structured interview and intervention evaluation. Participants received \$25 for completing the study. A research assistant was present throughout the intervention, for all groups.

Intervention

Yoga. Participants engaged in 12 rounds of sun salutations through a YouTube video progressively increasing in pace, displayed on a portable tablet. Sun salutations involves

performing 10 postures in a particular sequence, and involves transitions to and from standing and supine postures at a fast pace. After every four repetitions, participants performed a deep breathing exercise. The session ended with five minutes of guided relaxation in the corpse pose. To ensure safety, participants were oriented to the activity through a visual presentation of the postures and explanation of modified postures.

Aerobic exercise. Participants walked on a treadmill at a moderate intensity, i.e., between 55-70% of their heart rate maximum, which was derived using the formula $220 - \text{age}$, as recommended by the Center for Disease Control (Division of Nutrition, Physical Activity, and Obesity, 2020). Participants' heart rate was checked every five minutes, and the speed and incline was adjusted to keep them in the target heart rate zone. Participants were oriented toward the emergency stop button for safety.

Attentional control. Participants watched an educational video by Dr. Andrew Weil on healthy eating, in a quiet room without using their cell phones. Participants answered a survey serving as a fidelity check for their attention.

Measures

Demographics. Demographic characteristics, including gender, race, ethnicity, education, and income were reported by participants.

Biometrics. Height and weight were measured by a staff member. Heart rate was recorded before, during, and after the intervention, with a Fitbit Charge 3 which utilizes photo plethysmography. For cardiorespiratory fitness, participants were asked to choose one of five categories describing their current level of aerobic activity, ranging from sedentary to more than three hours of weekly PA. A composite score estimating participant cardiorespiratory fitness was

calculated using Jurca et al.'s formula (Jurca et al., 2005): $((\text{Gender (0 for women, 1 for men)} \times 2.77) - (\text{Age in years} \times .10) - (\text{Body mass index} \times .17) - (\text{Resting heart rate} \times .03) + \text{score from the physical activity question} + 18.07)$. A higher score indicated a higher level of cardiorespiratory fitness.

Feasibility and acceptance. Participants engaging in the yoga intervention rated the video for clarity and ease of understanding, and the yoga sequence for the pace, number of repetitions, difficulty level, and the breathing exercises. Responses were recorded on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), or a binary yes-no scale, or on a 5-point Likert scale ranging from 1 (very easy) to 5 (very difficult). Participants also completed a 15-minute semi-structured interview with open-ended questions such as ‘What did you like about the activity you just completed?’

Focus of attention. Participants rated their focus of attention (Hutchinson & Tenenbaum, 2007) whilst engaged in the intervention on an 11-point Likert scale ranging from 0 (external thoughts, environment) to 11 (internal thoughts, how body feels), after the intervention.

Perceived engagement. This was measured by the Game Engagement Questionnaire, which is a 16-item questionnaire assessing engagement while playing video-games (Brockmyer et al., 2009). In this study, we used it to assess engagement in the activity, after modifications. It includes absorption, presence, and flow subscales. The response options include ‘yes,’ ‘no,’ and ‘maybe.’

Anxiety. This was assessed with 10 items measuring state anxiety, from the 20-item State Trait Anxiety Inventory (Spielberger, 2010), pre and post intervention. Responses ranged from 1

(not at all) to 4 (very much so). A composite score was calculated by summing the responses after accounting for reverse coded items.

Stress. Participants rated their stress at the moment on a 100 mm visual analogue scale ranging from 0 (not stress at all) to 100 (maximum stress), pre and post intervention.

Affect. Participants rated their affect at the moment on an 11-point Feeling Scale (Hardy & Rejeski, 1989) ranging from +5 (very good) to -5 (very bad), pre and post intervention.

Self-efficacy. Participants rated their self-efficacy for engaging in yoga postures, breathing, and meditation, using the Yoga Self-Efficacy Scale (Birdee, Sohl, & Wallston, 2016), post-intervention. Responses ranged from 0% (low) to 100% (high). A composite score was calculated by averaging the item responses for each of the subscales.

Working memory. Participants completed the n-back task (1-back and 2-back match and non-match conditions), pre and post intervention. Participants had to respond whether the letter presented matched or did not match the letter presented previously (1-back), or two items back (2-back), as quickly and accurately as possible. Average reaction time and accuracy for each condition were calculated. Shorter reaction time may indicate better performance.

Processing speed. Participants completed the Digit Symbol Substitution Task pre and post intervention. Participants were shown 120 symbols and asked to read aloud the corresponding numbers, using a code-key presented, as quickly as possible in 90 seconds. Higher accuracy represents better performance.

Global cognitive functioning. Participants completed the pencil and paper version of the Trail-Making Task (TMT), part-A and B (more challenging), pre and post intervention. Participants have to adjoin a series of 25 numbers (1-25) in sequential order (TMT-A), or

alternate between numbers and letters (1-A-2-B; TMT-B). Completion time is recorded with a stopwatch. Shorter time-to-completion indicates better performance. All measures and timepoints are shown in Table 1.

Statistical analysis

Data were analyzed in SPSS v.27. Data were checked for outliers (± 2.5 standard deviations from the mean) and winzorized. Five outliers in TMT and one outlier in reaction time for 2-back non-match task were winzorized. There was no missing data. A 2 (time) x 3 (group) repeated measures analysis of covariance (ANCOVA) was conducted for n-back, TMT, and DSST. Covariates included baseline score, pulse pressure, estimated cardiorespiratory fitness, and education. A univariate ANCOVA was conducted for psychosocial measures, accounting for baseline scores. Bonferroni adjustment was used for post-hoc comparisons, and the alpha level was set at .05. Partial eta squared was used as the effect size (.05 or smaller = small, .06 = medium, .14 = large) (Olejnik & Algina, 2000).

Results

Baseline characteristics

Participants were mostly female (87.3%), mostly Caucasian (56.3%) and non-Hispanic (88.7%). Baseline characteristics are in Table 1.

Intervention fidelity, feasibility, and acceptability

There was a significant difference in post-session heart rate between all three groups ($p < .05$). The heart rate of yoga group was recorded after they engaged in the postures, instead of after breathing and relaxation. There was a significant difference between the two exercise

groups in the rating of perceived exertion and the control group, but not between the two exercise groups.

Most of the participants (72%) liked the pace of the sun salutation sequence, whereas others would have preferred a slower pace. Up to 80% of the participants thought that performing 12 repetitions of the sequence was adequate. Breathing exercises were liked by 80% of the participants. Most participants reported either 'yes' (56%) or 'maybe' (36%) to engaging in sun salutations as a long-term activity, and only 8% reported 'no'. All participants (100%) reported that they would recommend this activity to their family and friends.

The video instruction for yoga was liked by 68% of the participants. Participants found the video clear and understandable [$M (SD) = 6.08 (1.18)$], easy to follow [$M (SD) = 5.88 (1.30)$], and easy to learn the poses through the video [$M (SD) = 5.48 (1.45)$]. They reported a high likelihood of using yoga videos in the future to practice yoga [$M (SD) = 6.04 (1.43)$].

Psychosocial measures

Focus of attention, and perceived engagement was measured only post-intervention. There was a significant group difference with a large effect size [$F (2,68) = 31.56, p < .01, \eta_p^2 = .48$] in focus of attention. The yoga group had significantly more internal focus of attention, and the walking group had the most external focus of attention. There was a significant group difference, with a large effect size, on the game engagement questionnaire subscale of absorption [$F (2,68) = 6.63, p < .01, \eta_p^2 = .16$] and flow [$F (2,68) = 5.20, p < .01, \eta_p^2 = .13$], but not on presence [$F (2,68) = .60, p = .55, \eta_p^2 = .01$]. The yoga group was significantly more absorbed and experienced more flow as compared to the videos but not the walking group (see Table 3).

A univariate ANOVA revealed a statistically significant group differences with a large effect size [$F(2,67) = 4.94, p = .01, \eta_p^2 = .13$] in state anxiety, with the yoga group having significantly lower anxiety as compared to both groups.

There was a statistically significant group difference with a moderate effect size in stress [$F(2,67) = 3.13, p = .05, \eta_p^2 = .09$], with the yoga group having significantly lower stress as compared to both groups.

There was a statistically significant group difference with a moderate effect size on the feeling scale [$F(2,67) = 3.06, p = .05, \eta_p^2 = .08$], with the yoga group having a higher score as compared to both groups.

There was a significant group difference in the composite score for postures self-efficacy [$F(2,67) = 4.19, p = .02, \eta_p^2 = .11$], with the yoga group having higher self-efficacy compared to the walking group.

Cognitive measures

There was no significant group difference across time on reaction time of the 1-back match [$F(2,65) = 1.58, p = .21, \eta_p^2 = .05$], 1-back non-match [$F(2,65) = .27, p = .76, \eta_p^2 = .01$], 2-back match [$F(2,65) = .95, p = .40, \eta_p^2 = .03$], and 2-back non-match task [$F(2,65) = .84, p = .43, \eta_p^2 = .03$]. All three groups reduced in their reaction time similarly (see table 4). There was no significant group difference across time on accuracy of the 1-back match [$F(2,65) = .112, p = .33, \eta_p^2 = .03$], 1-back non-match [$F(2,65) = .64, p = .53, \eta_p^2 = .02$], 2-back match [$F(2,65) = .70, p = .50, \eta_p^2 = .02$], and 2-back non-match task [$F(2,65) = .40, p = .68, \eta_p^2 = .01$]. There was no significant group difference across time on the total number of correct responses on the digit symbol substitution task [$F(2,65) = .85, p = .43, \eta_p^2 = .03$]. There was no significant group

difference across time on the time taken to complete TMT-A [$F(2,65) = .37, p = .70, \eta^2 = .01$] and TMT-B [$F(2,65) = 1.09, p = .34, \eta^2 = .03$].

Discussion

We found that participants enjoyed the intervention, found it adequately challenging, and liked the video instruction. The yoga group had an internal focus of attention and higher self-efficacy for yoga postures (vs. the walking group), experienced more absorption, flow, and felt pleasant (vs. the videos group), and experienced lower level of anxiety and stress post-intervention, as compared to both groups. There was no group difference on the EF tasks.

The positive effect on psychosocial measures is similar to previous literature that has shown reductions in stress and anxiety following a long-term sun salutation intervention (Sakuma et al., 2012), an acute flow-based yoga intervention (Field, Diego, & Hernandez-Reif, 2010), other acute yoga interventions (Benvenuti et al., 2017; Huang et al., 2013; Melville et al., 2012; Szabo et al., 2017), and a higher effect in comparison to aerobic exercise (Winroth et al., 2019). In a recent acute yoga study, participants (physically active) in the meditative yoga group, but not the Vinyasa group, had lower anxiety and stress (Marshall et al., 2020). The study did not assess heart rate, and the null effects may be due to the activity being high intensity for the participants. In our study, heart rate and perceived exertion showed that the activity was not high intensity. There may be considerable variability in affective responses to higher intensity exercise (Ekkekakis, Parfitt, & Petruzzello, 2011). Thus, it is not altogether surprising that our study findings were inconsistent with higher intensity-style yoga, and future research should aim to determine the threshold of intensity that leads to diminishing returns. Additionally, because there were no significant differences in perceived mental fatigue across groups, the yoga activity may have allowed for greater mind-body relaxation. We found that a single session of yoga

increased self-efficacy for engaging in yoga. Few studies (none being acute studies), have examined changes in yoga self-efficacy post-intervention. A six-week Kundalini yoga intervention, which is focused on meditation, found higher self-efficacy for meditation as compared to postures. This supports our finding of increased self-efficacy for postures rather than breathing or meditation, as our intervention focused on postures.

We did not find significant differences on any of the EF tasks. Previous studies have found significant differences with the shape version of n-back (Gothe et al., 2013) but not with the letter version used in the present study (Bowden, Gaudry, An, & Gruzelier, 2012). There are minute distinctions in brain activation based on stimulus type, with verbal stimuli, but not non-verbal stimuli, being associated with increased activation in is the area responsible for language and speech (Nystrom et al., 2000; Owen, McMillan, Laird, & Bullmore, 2005), which may promote re-organization and manipulation of the stimuli. Engaging in yoga may be insufficient for augmenting language processing, as the focus during this activity is on quieting the mind and paying attention to body movements and breath. Few acute yoga studies measuring cognitive aspects have been conducted, with equivocal results owing to differences in the duration, type, and intensity of the yoga sessions, suggesting the need for more studies (Gothe et al., 2013; Luu & Hall, 2016).

Our results were contradictory to meta-analyses showing positive effects of aerobic exercise on EF (Chang, Labban, Gapin, & Etnier, 2012; Etnier et al., 1997). Most studies have shown small, positive effects on inhibitory control, which was not measured in our study (Pontifex et al., 2019). Our results also showed a small effect size, in terms of improvement on the tasks for all three groups. Pontifex and colleagues' (2019) review on the state of the literature on acute PA effects showed that effects on information processing have been equivocal. More

importantly, the authors pointed out that in spite of positive results on cognition from acute aerobic exercise, there is still much we do not about the interaction of type, intensity, and duration of PA and how it may impact EF. Even though our groups were similar in terms of the intensity and duration of the activity, yoga is a mind-body activity that is different in coordinative complexity from walking. Walking is a well-learned skill, and variability in pacing oneself on a treadmill may be anticipated, given its controlled nature (machine-calibrated and constant speed intervals). Yoga postures and transitions require practitioners to drive their experience, seek more challenging bodily extensions with each sequential repetition, and therefore have sustained attention for the duration of the session. Given that our yoga activity was higher in intensity than prior studies testing yoga effects on EF, the results from the current study are not directly comparable to prior research showing differences between yoga and aerobic activity. Additionally, the timing of cognitive assessments (Pontifex et al., 2019) and presence (or absence) of social interaction (Etnier et al., 1997) likely plays a substantial role in determining the impact of activity interventions.

The study has a number of limitations. Our sample was mostly young, female, white, and with a college degree, limiting generalizability to other populations. Although our sample size was not small, the study was underpowered to detect significant differences across groups. We did not assess physiological measures of stress or cardiorespiratory fitness. Irrespective of these limitations, our study contributed to the literature on psychosocial and cognitive effects of flow-based yoga through a scientifically rigorous, randomized controlled study design.

In conclusion, we found that a moderate-intensity flow-based mind-body activity had a more beneficial effect on psychosocial functioning as compared to moderate-intensity aerobic

exercise session. There was no effect of yoga or aerobic exercise on EF. The yoga intervention delivered via a video was enjoyable and challenging for participants.

Preprint

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Table 1 Measures

Variables	Baseline	Immediately pre- intervention	Immediately post- intervention
Demographics	X		
Biometrics	X		
Feasibility and acceptance			X
Focus of attention			X
State-Trait Anxiety Inventory (STAI)		X	X
Stress visual analogue scale		X	X
Feeling Scale		X	X
Self-efficacy	X		X
N-back		X	X
Digit Symbol Substitution Task (DSST)		X	X
Trail Making Task		X	X

Table 2 Baseline Characteristics

Variables	Yoga group (n = 25)	Walking group (n = 22)	Video group (n = 24)
Age in years (M, SD)	29.19 (8.60)	28.39 (8.83)	25.93 (9.16)
Female (n, %)	22 (88%)	20 (90%)	20 (83.3%)
Race (n, %)			
Caucasian	11 (44%)	12 (54.5%)	17 (40%)
African American	2 (8%)	3 (13.6%)	3 (12.5%)
Asian	10 (40%)	5 (22.7%)	2 (8.3%)
Other	2 (8%)	2 (9%)	2 (8.4%)
Ethnicity (n, %)			
Hispanic or Latino	1 (4%)	3 (13.6%)	4 (16.7%)
College degree (n, %)	8 (32%)	6 (27.3%)	5 (20.8%)
Previously engaged in yoga (n, %)	21 (84%)	14 (63.6%)	16 (66.7%)
Previously engaged in yoga for at least 6 months (n, %)	2 (8%)	2 (9.1%)	3 (12.5%)
Estimated cardiorespiratory fitness (M, SD)	13.10 (2.31)	12.95 (2.40)	13.14 (2.80)
Body Mass Index (M, SD)	24.26 (6.24)	27.16 (7.68)	27.80 (7.62)
Stress (PSS; M, SD)	20.84 (6.12)	21.45 (5.87)	22.12 (7.19)
Anxiety (HADS; M, SD)	8.28 (4.15)	10.13 (4.26)	9.75 (4.66)

Depression (HADS; M, SD)	7.04 (4.19)	7.60 (3.58)	6.83 (3.66)
Mindfulness (MAAS; M, SD)	3.70 (.76)	3.74 (.68)	3.64 (.79)

Note. M = Mean, SD = Standard deviation, PSS = Perceived Stress Scale, HADS = Hospital Anxiety and Depression Scale, MAAS = Mindfulness Attention Awareness Scale

Table 3 Mean and standard deviations of psychosocial and biometric variables post intervention

Measure	Yoga	Walking	Videos
Heart rate post session	100.24 (14.40)	119.27 (6.54)	69.63 (8.41)
Rating of perceived exertion	11.24 (2.16)	11.73 (2.14)	7.63 (2.39)
Focus of attention	7.84 (1.75) ^a	2.73 (1.48) ^a	5.42 (3.02) ^a
Game Engagement Questionnaire- Absorption	3.52 (1.90) ^a	1.91 (1.17)	2.86 (1.46) ^a
Game Engagement Questionnaire- Flow	5.00 (1.82) ^a	3.66 (1.37)	4.41 (.96) ^a
State Anxiety	30.04 (7.00) ^{a,b}	35.95 (8.93) ^a	36.00 (9.24) ^b
Stress	21.08 (17.22) ^{a,b}	28.82 (25.56) ^a	38.21 (21.54) ^b
Feeling Scale	3.68 (1.09) ^a	2.55 (1.26) ^a	3.21 (1.64)
Self-efficacy for postures	73.85 (17.16) ^a	63.07 (17.05) ^a	67.09 (21.82)

Table 4 Mean and standard deviations of cognitive variables

Measure	Timepoint	Yoga	Walking	Videos
N-back 2 non-match reaction time (ms)	Pre	960.72 (195.07)	1000 (190.18)	1002.11 (265.65)
	Post	827.50 (171.96)	844.26 (214.36)	832.60 (217.52)
Digit symbol substitution test	Pre	95.08 (13.68)	99.23 (10.73)	104.30 (12.84)
	Post	108.52 (16.73)	116.23 (12.17)	120.71 (18.41)
Trail making task-B	Pre	53.25 (14.00)	48.95 (10.55)	45.94 (7.20)
	Post	43.21 (11.12)	39.18 (8.50)	40.72 (10.28)

Figure 1 Sun salutation sequence (proceed in a clockwise direction)

Figure 2

Study CONSORT