



Improving the Health of Veterans Through Moving Meditation Practices: A Mixed-Methods Pilot Study
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Abstract

This study explores the use of low-to-moderate intensity mindfulness-based exercises (“moving meditation”) to improve veteran physical activity level, physiological health and psychological well-being, including posttraumatic stress disorder (PTSD) symptomology through a 12-week, pre- and post-test intervention, mixed methods pilot. Veterans with a history of posttraumatic stress disorder receiving care at the Department of Veterans Affairs Medical Center in Salem, Virginia were invited to participate. All veterans in the study participated in bi-weekly classroom instruction prior to a six to ten minute warm up period of Qigong exercises, followed by a 30 minute period of Taijiquan/Qigong or mindful-meditative walking, followed by a six to ten minute cool down period of light movement. Overall physical activity was measured for a one-week period before and after the 12-week intervention period with an Actigraph accelerometer. Physiological health indices were measured pre- and post- 12-week intervention, including salivary cortisol, Hgb A1C, fasting glucose, gonadal panel (FSH, LH, testosterone), albumin, hs-CRP, and sex hormone-binding globulin. Veterans’ mental well-being was measured by the Center for Epidemiological Studies-Depression Scale, the PTSD Checklist (PCL-C), the Cohen Perceived Stress scale, and the Beck Anxiety Inventory. Participants reported increased frequency and enjoyment of physical activity; improvement in Hgb A1C; improvement in balance and movement awareness; improvement in emotional regulation and focus; and reported reduced depression, stress and anxiety, and PTSD symptoms that benefitted social interactions. Moving meditations, such as Taijiquan and Qigong, may increase physical activity, improve physiological health, and enhance mental well-being, as part of a multifaceted treatment approach for veterans with PTSD.

Keywords: Taijiquan, Tai Chi, veterans, physical activity, alternative medicine, mixed methods

Introduction

Although active military personnel are expected to maintain a high level of fitness, only 47% of veterans meet daily physical activity recommendations (Littman, Forsberg, & Koepsell, 2009). Notably, veterans enrolled in Veterans Health Administration (VHA) care have higher rates of sedentary behavior than other veterans (Littman et al., 2009). The physical and mental health benefits of physical activity are widely known and include improved cardiovascular function and metabolic health, improved health-related quality of life, decreased perceived stress, and reduction in insomnia and somatic symptoms associated with depression and post-traumatic stress disorder (PTSD) (Kim et al., 2012; Ekblom-Bak, Ekblom, Vikstrom, deFaire, & Hellenius, 2014; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991; McAuley, Szabo, Gothe, & Olson, 2011). Given both the relative inactivity of VHA enrolled veterans and the benefits of physical activity, there is considerable interest in decreasing sedentary time and improving veteran physical activity.

Many veterans are receptive to improving their health and increasing their physical activity through complementary and integrative approaches such as Taijiquan and Qigong (TQG) (Hempel et al., 2014). TQG are systems of mind-body exercises that have their roots in meditation, traditional Chinese health practices, and the martial arts (Yang et al., 2007). Jahnke, Larkey, Rogers, Etnier, & Lin (2010) has argued that these practices are essentially forms of “moving meditation.” Multiple reviews of TQG exercises have demonstrated a wide range of mental and physical health benefits and documented the safety and efficacy of these exercises for rehabilitation and prevention of chronic physical and mental health conditions (Yeh, Wang, Wayne, & Phillips, 2009; Jahnke et al., 2010;

Hackney & Wolf, 2014; Zhang et al., 2014). Additionally, TQG exercises are considered low impact, safe, and accessible forms of integrative (mind-body) physical activity, even for participants with chronic pain conditions (Kong, et al., 2016).

An evidence map on Taijiquan published by the VHA Evidence-Based Synthesis Program (Hempel et al., 2014) identified 107 studies and systematic reviews, and it noted that Taijiquan can be effective in the reduction of stress, chronic pain, and fall risk, as well as general improvement in mood and quality of life. Those areas have been identified as priority areas for care by the VHA. Another VHA priority is the treatment of PTSD, which has not been well studied in relation to TQG exercise. However, a recent feasibility study shows that TQG exercise can be a safe, beneficial intervention for veterans with PTSD, and it is associated with high levels of participant satisfaction (Niles et al., 2016).

To the best of our knowledge, no studies have measured biomarkers in veterans participating in TQG, but researchers report positive hematological indices of the neuroendocrine and immunological response among non-veteran populations (Jahnke et al., 2010; Yang et al., 2007; Manzanque et al., 2004). Thus, TQG shows the potential to be part of a multifaceted prevention and treatment approach for veterans with PTSD and related comorbidities.

The primary objective of this mixed methods pilot study was to explore changes in the physiological health and mental well-being of participants while increasing their overall physical activity levels with low-to-moderate intensity moving meditation practices. We hypothesized that participating in a low-to-moderate intensity mindfulness-based physical activity intervention twice weekly for 12 weeks would improve physiological health, mental well-being, and increase physical activity.

Materials and Methods

Recruitment

Per IRB approved protocol (SCM0011), 94 eligible veterans were contacted for recruitment, either at check-in during scheduled clinic visits or by telephone after receiving an introductory letter and recruitment flyer by mail; some veterans self-referred after viewing flyers posted on facility bulletin boards. Thirteen veterans signed informed consent documents and completed the study enrollment process for the first group. Six participants dropped out of the pilot study due to time constraints and spouse/family commitments and one left due to disinterest, leaving seven participants to complete the 12-week protocol. The final sample for analysis included six men and one woman, with two African-Americans and five Caucasians averaging 64 years of age (range 56-78), with a mean body mass index (BMI) of 30.4 (range 24.7-38.0). All participants met the inclusion criteria of a history of PTSD.

Protocol

Each intervention session began with a brief check-in and discussion of key topics in mind-body exercise such as 1) basic principles of moving meditation practice; 2) awareness of physical, mental, and emotional states; and 3) extending the benefits of practice into everyday life. The check-in was followed by a brief (six to ten minute) opening practice using Hunyuan Qigong exercises for releasing physical tension and heightening awareness of breath and flow in movement. Following the opening practice, participants moved on to practicing walking meditations or other TQG exercises for approximately 30 minutes. At the end of this period, participants engaged in a six to ten minute closing TQG practice, which entailed a self-massage routine of gentle shaking, rubbing, and patting their own bodies.

Measures and Analysis

Overall physical activity was measured during waking hours for a seven day period that included two weekend days both pre- and post-intervention with an Actigraph accelerometer. Energy

expenditure, activity level, and activity duration were tracked, and participants were asked to wear the equipment whenever they were awake, except when bathing or swimming. Physiological health indices tested pre- and post-intervention included salivary cortisol, glycated hemoglobin (Hgb A1C), fasting glucose, gonadal panel (follicle stimulating hormone [FSH], luteinizing hormone [LH], testosterone), albumin, high sensitivity C-reactive protein (Hs-CRP), and sex hormone-binding globulin (SBG). Veteran mental well-being was measured by the Center for Epidemiological Studies-Depression Scale (CES-D), the PTSD Checklist (PCL-C), the Cohen Perceived Stress scale (PSS), and the Beck Anxiety Inventory (BAI). All measures were taken pre- and post-intervention, and the results were analyzed using paired-sample t-tests.

The CES-D is a composite of 20 items selected from the Zung Self-rating Depression Scale, the Beck Depression Inventory, the Raskin Scale, and the Minnesota Multiphasic Personality Inventory Depression Scale. A cutoff score has been demonstrated to identify individuals likely to have a depressive illness and higher scores are indicative of more severe symptoms. Internal consistency is high Cronbach's $\alpha = 0.85$ in community samples and 0.90 in psychiatric samples (Björgvinsson, Kertz, Bigda-Peyton, McCoy, & Aderka, 2013).

The PCL-C is a self-administered 17-item checklist for PTSD exposure used by the VHA and requires five minutes to complete. PTSD symptoms may be the result of one or several traumatic events and are not restricted to combat exposure (Weathers et al 2013).

The PSS was used to assess perceived stress and thoughts and feelings experienced during the last month and how often they were experienced (Cohen, Kamarck, & Mermelstein 1983). High levels of stress have been found to be a risk factor for heart disease and higher mortality (Redmond, et al 2013). This 10 question Likert scale instrument has been widely used, including veteran populations, and is considered valid and reliable with an internal consistency of Cronbach's $\alpha = 0.82$ (Redmond et al 2013; Roe et al 2013; Saxton et al 2014). A score of 13 and below is considered average. High stress scores are 20 and above.

The BAI is a 21 item self-report measure of anxiety with internal consistency Cronbach's $\alpha = 0.92$ and test retest reliability of 0.75 (Beck, Epstein, Brown & Steer, 1988.) The BAI is a short, easy to score measure of anxiety symptoms experienced over the past month. This assessment tool minimizes depressive symptom overlap and has demonstrated sensitivity to change. It was used to supplement the PSS. Belem da Silva, Schuch, Costa, Hirakata, & Manfro (2014) and Zhang et al (2014) discovered an inverse relationship between symptoms of anxiety and physical activity in studies using the BAI; somatic symptoms of anxiety, as measured with BAI, are associated with physical inactivity.

To better understand veteran's perceptions of benefits, problems or barriers to participating in the program, participants were interviewed in a panel at the end of the study. Open ended questions were posed to the panel on the following topics: 1) impact on sense of well-being; 2) the most helpful and challenging parts of the program, including potential barriers or anything in the program that might have been perceived as harmful; 3) whether participants would continue practicing after the study. Participants' answers to these questions led to follow up questions related to physical and emotional wellbeing, as well as barriers to participation. A thematic analysis was conducted on the interview transcripts and the major findings are presented.

Results

Physical activity

Actigraph data indicates that four of the seven participants were less sedentary after 12 weeks (ranging from a 7.9%-12.8% decrease in sedentary time), while one participant's physical activity levels remained unchanged, and one participant became more sedentary (a 12.1% increase in sedentary time).

Physiological measures

Results for the physiological measures are summarized in Table 1 (bold indicates statistical significance at $p \leq .05$). Physiologic outcomes varied and only one measure showed a small but significant improvement: Hgb A1c, a reliable measure of long term blood glucose readings (Ikeda & Shimazawa, 2019). Gonadal function (FSH, LH, testosterone) and sex hormone binding globulin (SBG) which we anticipated may be influenced by perceived stress levels was not compromised (Briski, 1996; Whirledge & Cidlowski, 2010). Salivary cortisol was of interest to the team as it is a biomarker of stress. There was no improvement in salivary cortisol levels despite improvement in stress and anxiety questionnaire scores. Salivary cortisol results are strongly influenced by collection and storage techniques, the time of day the sample was collected, and the participant's intake of food or drink prior to collection which we were not able to completely control (Lewis, 2006). Albumin, a gross measure of nutritional status and response to acute pathophysiologic events, did not show a statistically significant change (Smith, 2017). Lastly, HS-CRP rose slightly but was not statistically significant. Increases in HS-CRP may be seen with inflammatory conditions and heart disease (Wium-Anderson, Orsted, Nielsen, & Nordestgaard, 2013).

Table 1. Physiological indices (n=7)

<i>Measure</i>	Mean Pre-	Mean Post-	Δ	p-value
FSH	4.92	5.02	+0.10	0.479
LH	4.58	4.75	+0.17	0.994
Glucose	104.3	99.3	-5.00	0.495
Hgb-A1C	5.76	5.61	-0.15	0.016
Salivary Cortisol	0.17	0.41	+0.24	0.162
SBG	44.94	45.60	+0.66	0.707
Albumin	3.89	3.93	+0.04	0.573
Testosterone	380.2	310.7	-69.5	0.331
Hs-CRP	3.68	5.09	+1.41	0.474

Measures of mental well-being

All participants showed a reduction in mental well-being scores reporting improvements in symptoms of depression, anxiety, stress, and PTSD. Results for the psychometric measures are summarized in Table 2 (bold indicates statistical significance at $p \leq .05$).

Table 2. Measures of mental well-being (n=7)

<i>Measure</i>	Mean Pre-	Mean Post-	Δ	p-value
PCL-C (PTSD)	57	39	-18	.001
CES-D (Depression)	29	23	-6	.035
PSS (Stress)	24	16	-8	.046
BAI (Anxiety)	29	13	-16	.050

A panel interview with veterans at the end of the study indicated that they believed the moving meditation program was beneficial physically and emotionally and that it reduced stress or anxiety in ways that benefitted family relationships. Participants reported physical health benefits including increased motivation, engagement, frequency and enjoyment of physical activity, as well as improvements in balance and movement awareness. The participants maintained that these benefits carried over into everyday activities such as walking. They also reported improved mood, emotional regulation and focus, as well as social interactions.

Participants indicated that the program had no adverse effects, but that medical appointments sometimes conflicted with practice times. They also indicated plans to continue practicing the exercises they learned with the help of demonstration digital versatile discs (DVDs) provided by the program. Veterans reported the need to expand the advertisement and reach of this program to their peers. They believed that more veterans would benefit from participation in the program, even those not clinically diagnosed with PTSD, and made various suggestions for increasing awareness and involvement of veterans receiving care at the facility.

Discussion

Study outcomes are informative despite the limitations of the pilot sample size. All participants (n=7) improved on every measure of mental well-being, four participants showed improvements on Hgb A1C (2 remained unchanged from the baseline), and physical activity profiles showed a notable decrease in five individual scores on sedentary time (with 1 unchanged and 1 slightly increasing). Thus, our findings in this pilot study of veterans with PTSD agree with other findings on “moving meditation” or mindfulness-based exercise and its potential to support physical and mental health benefits (Jahnke et al., 2010; Kong et al., 2016; Niles et al., 2016).

Actigraph data suggests that the bi-weekly intervention with its emphasis on incorporating lessons into daily physical activity had a mainly positive affect on decreasing overall sedentary time. As a result, this decreased sedentary time may have led to the improvement in Hgb A1C, an important measure of diabetes. The universal improvement on psychometric testing suggests that 12 weeks of low-to-moderate intensity, mindfulness-based exercise—such as Taijiquan, moving Qigong and mindful walking—has the potential to increase subjective well-being in individuals with anxiety, depression, stress, and PTSD symptomology.

While the small sample of the pilot study and the single group design prevent us from making strong conclusions about the findings or generalizability, the degree of change in quantitative scores for seven individuals was remarkable and worth further exploration. Insight from the panel

interviews suggest that the change may not have been driven by the twice weekly practice alone, but rather by the veterans' willingness and ability to transfer learning in the class to daily life, including increased physical activity, mindfulness, and emotional regulation. Future studies should pay close attention to opportunities for transfer of learning into daily activities, stress levels and emotional regulation, even if formal practice is not held daily.

Transportation and perceived lack of time are barriers to participation in any program and point to a need to develop and test digital technologies to support veteran access to interventions and validated treatments. Further research into the costs and benefits of digital platforms is warranted for programs in which recruitment and retention is an issue, as they were in this pilot study. Limitations to the pilot include the small sample size which impacted the analysis and prevent causal inferences based solely on the intervention protocol, despite statistically significant results. Future studies can avoid this limitation by implementing a randomized controlled design with comparison groups containing multiple types of mindfulness-based exercise. Such studies would increase understanding of the range of mindfulness-based exercises that might yield similar or other unknown benefits. This knowledge would be particularly useful when working with populations with various forms of physical limitations, such as those imposed by cardiac, pulmonary, and other health issues as well as orthopedic limitations common among veteran populations.

Conclusions

The results of this twice weekly, 12-week pilot study support previous findings on the general benefits of moving forms of meditation, such as TQG exercises, for physical and mental well-being. Actigraph data showed a decrease in overall sedentary time, which may have been tied to the small but meaningful change in a key index of physiological health, Hgb A1C. All participants reported improvements in their sense of subjective well-being through reduced symptoms of depression, anxiety, stress, and PTSD. The protocol was safe, feasible, and well received by the intended population, but study findings are limited by the sample size. Future Randomized Controlled Trials (RCT) would be useful in investigating the effectiveness of low-to-moderate intensity mindfulness-based exercises (e.g. Taijiquan, Qigong, and mindful walking) as part of a multifaceted treatment approach for veterans with PTSD and related comorbidities.

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