Research

Yoga for Heart Failure Patients: A Feasibility Pilot Study with a Multiethnic Population

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Abstract: Background: Congestive heart failure (CHF) is highly prevalent and the most costly cardiovascular illness in the United States. Yoga is known to be effective in lowering stress, lessening depression, and increasing physical fitness and may be used as an adjuvant management program for CHF patients. Primary Study Objective: To determine the feasibility of a yoga intervention program among a multiethnic CHF population living in underserved neighborhoods. Methods: Uncontrolled intervention trial. Setting: Kaiser Permanente Medical Centers, Richmond and Oakland, California. Participants: 14 CHF patients (7 female), mean age 64 (SD = 6.4) years, and 62% African-American. Intervention: Eight-week, 2x/week, 1-hr yoga classes that included meditation, breathing exercises, gentle yoga poses, and relaxation. Primary outcome measures: The intervention feasibility was measured by recruitment rates, participant retention and adherence. Body weight and self-reported depression and quality of life were measured before and after the intervention. Results: Among the 14 patients enrolled, 13 completed the intervention. Of those who completed the trial, 92% attended at least 50% of the classes. There was a significant reduction in weight (-3.5 lb, p = 0.01) and improvement in the severity of depression (p < 0.05), as well as a trend toward increased quality of life (p = 08). No adverse events were observed. Conclusions: This pilot trial demonstrates that it is feasible for patients with CHF to incorporate yoga into their lifestyle. Yoga may help with routine disease management, prevention of fluid retention, and improvement of depression and quality of life. A larger trial is needed to confirm efficacy and to determine the long-term effects on other important outcomes, such as hospital re-admission rates or prognostic biomarkers.

Key words: Yoga, meditation, congestive heart failure, weight, depression, quality of life, relaxation, breathing, hospitals

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Background

It is estimated that 5.8 million people in the United States are living with congestive heart failure (CHF), and it is the most common cause of hospitalization for adults over the age of 65 years.1 2 CHF is characterized by high mortality and hospitalization rates; physical, emotional, and functional impairment; depression; reduced quality of life; and increased caregiver burden.3 4 Depression and low quality of life are common among patients with CHF because of their limited functional capacity, and weight gain due to fluid retention is a significant clinical issue among this patient population. Because of its high prevalence and associated high medical resource consumption, CHF is now the single most costly cardiovascular illness in the United States, with total costs estimated at $39.2 billion in 2010.2 Given the high incidence and
severity of the disease, it is important to understand the impact of low-cost self-management strategies on clinical outcomes.

Systematic reviews of disease management programs for CHF patients have consistently found that programs including exercise reduce total healthcare cost by improving quality of life and reducing hospitalization rates. Recent evidence also suggests that psychosocial factors such as depression and social support are associated with prognosis in CHF outpatients, independent of biomedical risk factors. The American Heart Association recently reported that stress reduction is one of the most important recommendations for patients with CHF.

Yoga is a traditional modality that includes both physical movement and relaxation techniques that often result in stress reduction, improved mood, and heightened awareness in the general population. There is a growing body of research suggesting that the practice of yoga may reduce the risk factors for cardiovascular diseases and may attenuate signs, reduce complications, and improve the self-care and prognosis of those with chronic disease. In addition, yoga is known to be effective in improving psychological health for patients with cardiovascular diseases by lowering stress, lessening depression, and improving mood and mindfulness. When taught in group classes, it additionally provides opportunities for social connection and support. Requiring little in the way of equipment or professional personnel, yoga is easy and inexpensive to practice, even by elderly, ill, or disabled individuals, making yoga promising as a safe and cost-effective adjuvant management program for patients with CHF.

Although yoga has been found to be effective in other cardiovascular conditions, little is known regarding the feasibility of a yoga intervention among CHF patients and its potential health effects. We thus conducted a pilot study of an 8-week yoga intervention for multiethnic patients with CHF. The primary objective was to test the feasibility of a yoga intervention for a community-based, racially diverse CHF patient population living in neighborhoods where yoga or other mind-body modalities are not readily available. The secondary objective was to explore the effects of the intervention on weight, depression, and quality of life. We measured weight as a proxy for fluid retention (often caused by excess sodium intake), which is a key contributing factor in the development and progression of heart failure.

Methods

Setting

This uncontrolled pilot study was conducted within the Kaiser Permanente, Northern California (KPNC) population, an integrated health services delivery organization. The KPNC membership contains approximately 3.3 million persons whose demographics closely approximate the underlying census population of Northern California. Patients with a diagnosis of CHF were identified using Kaiser Permanente’s electronic medical record and were contacted after obtaining consent by the patients’ primary care physician. The study inclusion criteria included being a patient at KP Richmond or Oakland; having a diagnosis of congestive heart failure within 2008 (ICD9 code 4280); age >18 years; being able to understand and willing to sign a written informed consent document; and having a consent from the primary care physician. Patients were excluded if they: were unable to travel to the clinic twice a week for 8 weeks; had a regular yoga practice; had major psychological problems; could not move their arms; or were unable to understand English. After initial telephone screening, a detailed medical chart review was conducted by a board-certified cardiologist (JR) to confirm the presence of CHF. Those who were eligible and wished to participate had an in-person interview with a trained interviewer and signed the informed consent.

Yoga Intervention

The participants received 1-hour Hatha yoga classes for 8 weeks, 2x/week (total 16 classes). The yoga protocol was developed by the Niroga Institute, a local nonprofit yoga organization based in Oakland, California, that promotes yoga for individuals with specific needs, including medical patients. The classes incorporated relaxation, centering meditation, breathing exercises (pranayama), and gentle postures (asana) that improve strength, flexibility, balance, and endurance. The general sequence is presented in Table 1. More detailed examples of poses and their expected benefits are described in Appendix 1.

| 1. Check-in of home practice and adverse events |
| 2. Centering meditation and breathing exercises (e.g., abdominal breathing, thoracic breathing) to cultivate mindfulness. (sitting in a chair) |
| 3. Standing poses (e.g., twists, neck/shoulder stretch, side bends) |
| 4. Reclining poses (e.g., bridge pose, gentle abdominal exercise, hips and legs stretches) |
| 5. Seated poses (e.g., forward bends, gentle twists, either on a chair or mat) |
| 6. Viparita karani (legs-up-the-wall relaxation pose) |

Table 1. General class sequence.
A certified yoga teacher from the Niroga Institute taught all the classes. The instructor had been trained to teach therapeutic yoga for individuals with physical challenges, and the protocol was created specifically for patients with heart problems. The poses were modified to accommodate individual challenges by using props such as chairs, straps, and blocks whenever necessary. At first, classes included only a few of the poses listed in Appendix 1, and as the students progressed, the number of poses increased accordingly, as determined by the instructor.

In addition, the participants received a yoga mat and a 20-minute DVD developed by Niroga to practice at home. The participants were asked to complete a yoga diary to indicate whether they practiced yoga at home. The study protocol was approved by the KPNC Institutional Review Board.

Outcome Measures
All participants signed an informed consent form and completed an in-person interview with a trained interviewer approximately a week prior to starting the yoga session. A post-intervention interview was conducted over the phone \((n = 10)\) or in-person \((n = 4)\). Body weight was measured by an interviewer at the time of the in-person interview. When the interview was conducted over the phone for post-intervention assessment, self-reported weight was used. We verified the self-reported weight with the most recent weight indicated in the electronic medical record to check consistency. When there was a significant discrepancy between the most current weight and the reported weight (>2lb), the weight in the electronic medical record was used. Severity of depression was measured by the Depression-Arkansas Scale (D-ARK). The D-ARK is a brief, economical, multipurpose 4-point scale instrument that has been validated for assessing major depressive disorder and depressive-symptom severity. The 11-item scale includes items pertaining to each of the nine symptom criteria in the DSM-IV, plus an additional suicide-risk question. The D-ARK can be scored as a symptom-severity scale by summing up the values for each endorsed response and multiplying the total by a constant to range from 0–100. Disease-specific quality of life was measured by the Kansas City Cardiomyopathy Questionnaire (KCCQ). The KCCQ is a 23-item, disease-specific measure that quantifies four clinically relevant domains of patients’ health status, including physical limitations, symptoms (frequency, severity, and change over time), a heart failure-specific assessment of their quality of life and their perceived social limitations due to heart failure, and a self-efficacy domain (a measure of patients’ knowledge of how to best manage their disease). The four health status scales can be combined into a single, overall summary score. Scores range from 0–100, where higher scores indicate better functioning, fewer symptoms, and better disease-specific quality of life.

Statistical Analyses
Data from all instruments were evaluated for completeness. Frequency distributions were checked for extreme or inconsistent values. Descriptive statistics were used to characterize the sample. Differences between baseline and post-intervention scores were analyzed with a paired \(t\)-test for variables with normal distribution and a nonparametric Wilcoxon signed-rank test when the distribution was skewed, to ascertain significant change over time. The McNemar’s test was used for categorical variables. These analyses were done using SAS 9.1 statistical software.

<table>
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<tr>
<th></th>
<th>(N) (%) or Mean ± SD</th>
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<tbody>
<tr>
<td>Age (years)</td>
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<tr>
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<tr>
<td>Systolic</td>
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</tr>
<tr>
<td>Diastolic</td>
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<tr>
<td>Body Mass Index (BMI)</td>
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<tr>
<td>Attendance Rate</td>
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<tr>
<td>&gt; 80%</td>
<td>7 (54)</td>
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<td>≤80% &amp; &gt;50%</td>
<td>5 (38)</td>
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<tr>
<td>≤ 50%</td>
<td>1 (8)</td>
</tr>
</tbody>
</table>

Table 2. Demographic characteristics of the participants \((N = 13)\).

Results
Participants
Fourteen patients (7 women and 7 men) were eligible and signed the informed consent. The baseline characteristics of the participants are shown in Table 2. Among those
who were interested in participating, the main reasons for nonparticipation were: unable to attend the yoga sessions due to schedule conflict and absence of signs of CHF after the detailed chart review. The mean age of the participants was 64 (SD = 6.4) years, and 85% were non-Whites. The majority of the participants had systolic heart failure, and most lived in Richmond, California, where access to yoga or a safe neighborhood to exercise in is limited. One of the participants used a wheelchair with an oxygen tank, and another participant used only oxygen support.

**Attendance**

Of the 14 participants who were enrolled in the study, one person discontinued participation after 4 weeks due to illness and did not complete the study. The remaining 13 participants completed the outcome measures after the intervention. Eight participants attended more than 75% of the classes, while one person attended less than 50%. Main reasons of nonattendance were health-related (i.e., too tired, sick, etc.) or due to conflicting doctor's appointments.

**Primary Outcomes**

Changes in weight, severity of depression, and quality of life pre- vs. post-intervention are reported in Table 3. The mean body weight at baseline was 193 lb (SD = 39.5). After the intervention, the mean weight decreased to 190.2 lb (SD = 37.2) from baseline (-3.5 lb; \( p = .01 \)). The mean depression severity score was reduced from 21.2 (SD = 13.8) to 12.6 (SD = 12.2). At baseline, 8 participants reported moderate to severe depression; after the intervention, this number was reduced to 4 participants (\( p < .05 \)). The overall summary of the quality of life score measured by KCCQ at baseline was 71.6 (SD = 23.3), and had increased to 80.3 (SD = 11.2) after the intervention (\( p = .08 \)).

**Home Practice and Qualitative Comments**

Many participants indicated that they practiced at home at least few times a week, some with the DVD, and some without the DVD. A few participants engaged in pranayama and meditation practice primarily. Because of missing or unreliable data, we were unable to conduct statistical analysis to evaluate if home practice was associated with the outcomes.

The following are qualitative comments from the participants:

“I felt much better even after just one week, so I have arranged for my staff to start doing weekly yoga sessions with the DVD!”

“I feel beautiful.”

“My husband (who joined the participant to practice yoga) is grateful, as he notices he feels better in his body, more relaxed, and happy his wife is happy.”

“Breathing has a great impact of being able to breathe easier, with less heart stress.”

**Discussion**

The present study demonstrated that a yoga program was feasible and well-accepted among multiethnic patients with CHF. Nearly all participants completed the intervention, and the majority attended more than 80% of the classes. Qualitative comments from the participants indicate the positive effects on their lives, as well as their family members. Participants also indicated that they hoped to continue to practice yoga after the study ended. Although preliminary, our results suggest that yoga may be safely used as an adjuvant disease management strategy for CHF and justify a larger randomized clinical trial to further evaluate its clinical efficacy as well as long-term sustainability.

Our study results corroborate a recently conducted, similarly designed yoga intervention study of heart failure patients.\(^{17}\) In that study, 15 patients were recruited to an 8-week yoga intervention that demonstrated that subscales of quality of life were improved significantly, as well as other physical outcomes such as balance, endurance, and strength. Our results also support the results from another recent study that demonstrated the feasibility of a yoga intervention in an African American CHF patient population.\(^{18}\) That study showed that yoga was associated with improvement in flexibility, treadmill time, and inflammatory biomarkers such as IL-6 and C-reactive protein. We extended previous knowledge by demonstrating the potential beneficial effects of yoga on weight (as a proxy for fluid retention) and depression severity.

In spite of significant advances in clinical management of heart failure, more than 50% of patients seek hospital readmission within 6 months after initial treatment, and the average duration of hospital stay is 6 days; approximately 50% of people diagnosed with CHF will die within 5 years.\(^{2}\) Previous studies have demonstrated that psychosocial factors such as depression and reduced quality of life contribute to recurrent CHF exacerbations and hospitalizations,\(^{19}\) further justifying the benefit of adjuvant therapy that helps improve psychological health and quality of life of CHF patients.
Table 3. Pre- vs. post-intervention changes in outcomes. [KCCQ: Kansas City Cardiomyopathy Questionnaire; ** McNemar test; all other analyses report a student t-test for paired data.]

Our study, along with the few other studies, demonstrate the feasibility of yoga for CHF patients and acceptability among multiethnic population, suggesting that yoga can be an inexpensive and safe modality that could be used as an adjuvant therapy for CHF patients.

Although the main aim of the study was to test feasibility, we also observed trends in weight reduction and improvement in depression and quality of life. However, the results should be interpreted with caution because of the nature of an uncontrolled study and the use of self-report. Self-reporting of depression and quality of life might have biased post-intervention because of participants’ expectations or perceived expectations of the interviewer. For a small number of participants, we used self-reported weight instead of direct measures. Although we verified the self-reported weight and the measured weight using the electronic medical record on the closest dates to the end of the intervention, the measurements may not be accurate. To better assess the efficacy of the intervention, a larger scale randomized clinical trial is needed.

It should also be noted that the study participants may not be representative of all CHF patients. The majority of the participants had systolic heart failure (ejection fraction <40%). Systolic heart failure patients are sicker than diastolic heart failure patients, indicating that our study group was probably less healthy than the general CHF patient population. Furthermore, yoga sessions were conducted during the day (11AM) on weekdays. This excluded many patients who worked during the day, making our participant group potentially sicker than general CHF population. The fact that participants may have been sicker at baseline than the general CHF population provides further support...
to the feasibility of a yoga intervention, because it suggests that self-selection bias by healthier subjects was not present. However, future studies should make sure to include working and nonworking patients, as well as patients with diastolic heart failure, in order to make the results more generalizable to the target population.

The strength of the study includes the use of a multiethnic patient population from underserved neighborhoods. The majority of the patients were recruited from Richmond, California, where a large proportion of the population is African American and there is relatively limited accessibility to yoga, other exercise facilities, and safe neighborhoods. We have demonstrated that yoga was acceptable among this population, and many patients were able to practice yoga safely at home without supervision.

In conclusion, our study demonstrated that a yoga intervention was feasible among multiethnic CHF patients and that there were trends of improvement in depression and quality of life and moderate weight reduction. A randomized clinical trial is needed to test the efficacy of yoga on long-term medical outcomes (e.g., hospital readmission rates and emergency room admission rates) or on prognostic biomarkers such as B-type natriuretic peptide (BNP). An active control group should be carefully considered to determine the independent effect of yoga practice from social support or other confounding factors.

Appendix 1. Sample Yoga Protocol

- Vertical Trunk-Twisting Movement: increase spinal mobility; move fluid into intervertebral discs
- Shoulder Stretch (circular motions in each direction, up/down, forward/back, circles): stretch upper back; relieve accumulated tension in upper torso
- Neck Stretch (3 times in each direction, up/down, rotation, side bend): enhance cervical spine range of motion; relieve tension in neck
- Standing Side Bend (3 times/side on exhale, feet apart, one arm up): lateral stretch for spine and muscles on the sides of the torso
- Rhythmic Thoracic Breathing (8 times, counting to 4 on inhale and 8 on exhale): increase pulmonary efficiency; relaxing, rejuvenating
- Supine Hip Raise (bridge pose; knees flexed, arms on side with palms down, 8 times on inhale): strengthen hip extensors; stretch hip flexors
- Supine Leg Raise (one-leg raise, hips on forearms, leg straight, 8 times/side on inhale): stretch hamstrings; strengthen hip flexors
- Alternate Knee-to-Chest Movement (12 times/side, breathing normally; 3 variations, including with raised head and shoulders): articulation of hip and knee joints; stretch and strengthen quads and hamstrings; strengthen core
- Abdominal Curls (12 times each at center, right side, and left side): strengthen central and transversal abdominal muscles, and obliques
- Abdominal Twists (8 times on each side; sustain for 30 sec on each side): stretch internal and external obliques, and transverse abdominals
- Sitting Forward Bend Movement (from base of spine, legs extended, 8 times on exhale): stretch hamstrings; strengthen hip flexors
- Prone Boat (symmetrical lift of shoulders and heels, legs extended, 8 times on inhale): strengthen paraspinals and hip extensors; stretch hip flexors
- Cat-Cow Poses (8 times: upward-facing cow on inhale, downward-facing cat on exhale): regulated spinal flexion and extension; increased control of lumbar curve
- Sitting Spinal Twist (sustain for 30 sec on each side, maintaining vertical spine): spinal mobility; stretch abdominal core
- Wall-Supported Inversion (hips close to wall, legs extended, facing wall, held for 2 minutes): improve venous return from lower limbs; aid lymphatic return towards heart
- Corpse Pose for Relaxation (posture held for 5 minutes; optional rhythmic abdominal breathing, counting to 4 on inhale with abdomen out; counting to 8 on exhale with abdomen in): relaxation; increase oxygen intake
- Meditation (5 minutes, sitting up in any comfortable position):
  - Watching breath and mind mindfulness practice for stress reduction, impulse control, enhanced self-awareness, development of detachment and dispassion, fearlessness and desirelessness

References


