THE EFFECTS OF A SINGLE BOUT OF HIGH- AND MODERATE-INTENSITY YOGA EXERCISE ON CIRCULATING INFLAMMATORY MEDIATORS: A PILOT FEASIBILITY STUDY

Dennis Muñoz-Vergara[1,2], Kristin L. Schreiber[3], Helene Langevin[4], Gloria Y. Yeh[1,5], Yehui Zhu[6], Pamela Rist[1,2], Peter M. Wayne[1,2]

[1]Osher Center for Integrative Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, MA (DMV, GYY, PR, PMW); [2]Division of Preventive Medicine, Brigham and Women's Hospital (BWH), Harvard Medical School (HMS), Boston, MA (DMV, GYY, PR, PMW); [3]Department of Anesthesiology, Perioperative and Pain Medicine, BWH, HMS, Boston, MA (KS); [4]National Center for Complementary and Integrative Health (NCCIH), National Institutes of Health (NIH), Bethesda, MD (HL); [5]Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center, HMS, Boston, MA, United States (GY); [6]Department of Radiology, Massachusetts General Hospital, A. A. Martinos Center for Biomedical Imaging, HMS, Boston, MA (YZ)

INTRODUCTION

Large # of yoga studies
Disease populations

Yoga Pathophysiology

Knowledge gap: Yoga exercise studies in healthy and yoga-naïve individuals

Small # of yoga studies
Healthy populations

Yoga Physiology

Aims

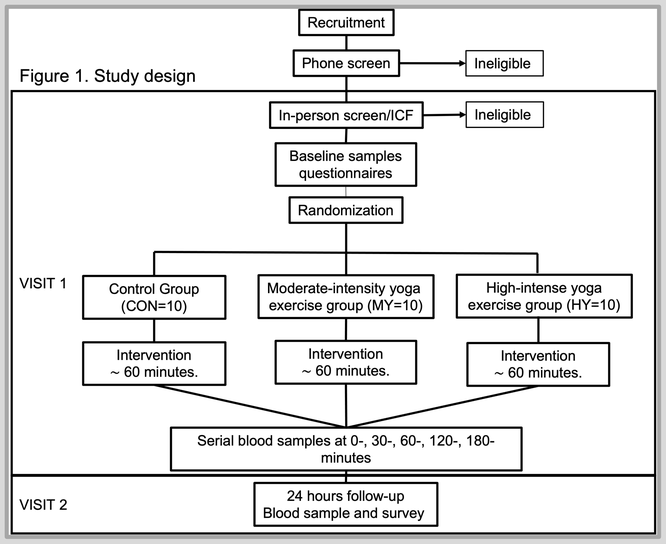
To evaluate the **feasibility** of conducting an RCT to study the acute effects of high- and moderate-intensity yoga exercise protocols compared to a sedentary CG on inflammatory outcomes in healthy yoga-naïve individuals

To characterize the **temporal responses of a battery of systemic circulatory cytokines** in response to two intensities of yoga exercise, specifically evaluate if:

a) An acute bout of yoga exercise impacts circulating levels of a battery of cytokines
b) Cytokines associated with the myofascial system show responses to yoga exercise similar to other exercise interventions
c) Cytokine responses to yoga are intensity dependent
d) Responses of specific cytokine are associated with others in response to a bout of yoga exercise

Materials and Methods

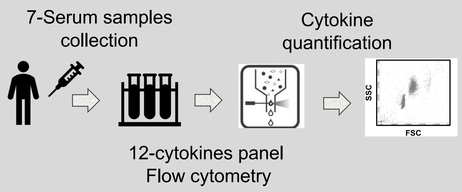
Figure 1. Study design



Outcomes

Feasibility metrics	Target goal
% of eligible participants were enrolled	60%
# of months required to complete the recruitment	9
Retention rate (% participants completing 2 study visits)	> 70%
Completion rate of questionnaires	> 75%
Completeness of physiological measures (HR and blood)	> 80%
Adherence rate to the yoga exercise protocol	> 75%

Laboratory data collection

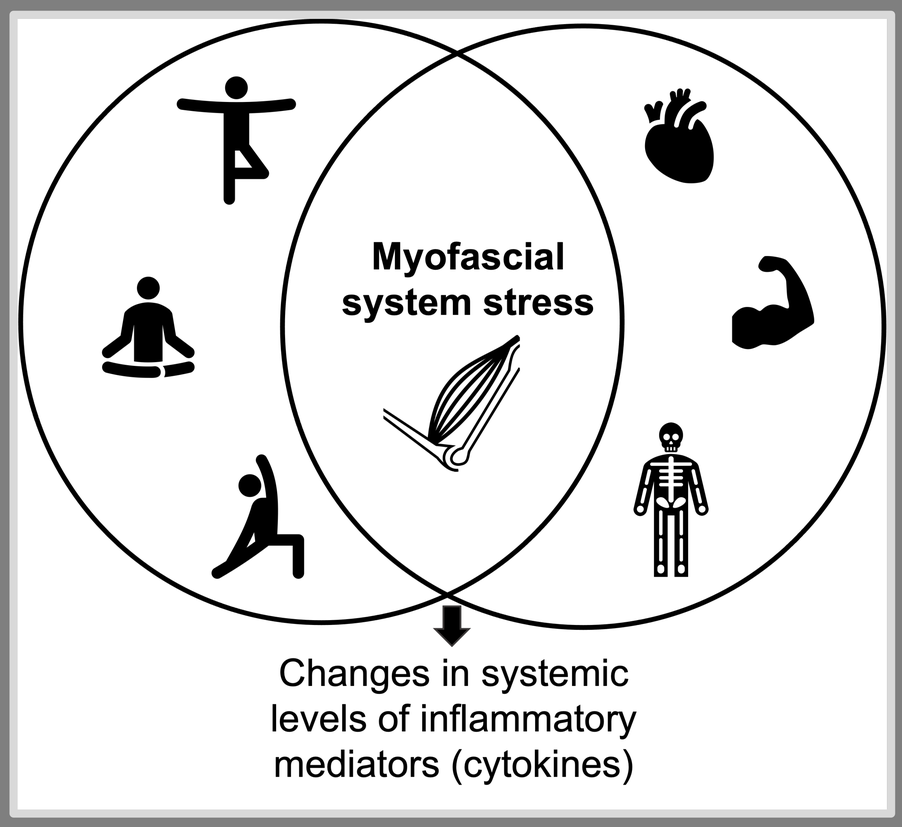


Statistical methods

Type of data	Method
Demographics, feasibility metrics, PROMIS intensity pain score, and HR	Descriptive stats GraphPad
Exploratory analysis of cytokines levels	
✓ Exploratory longitudinal analysis	SAS
✓ Exploratory net Area Under the Curve (netAUC)	SAS and GraphPad
✓ Intercorrelation matrices / heatmaps	GraphPad

What is New

To our knowledge, this is the first randomized study to evaluate the effects of a single bout of yoga exercise on immune-mediated markers of inflammation in yoga-naïve and healthy adults.



Main Results

Our preliminary results suggest that a single bout of yoga impacts systemic inflammatory processes in yoga-naïve and relatively sedentary participants. Trends/patterns observed in IL-6 and IL-33 warrant further investigation in a fully powered study.

Conclusions

A larger powered-RCT for understanding the short-term effects of yoga exercise on systemic inflammatory mediators is both feasible and warranted.

Scan & download poster

Email: dmunozvergara@bwh.harvard.edu

RESULTS

Table 1. Baseline characteristics of the study participants

	Mean ± SD, n(%)		
Variable	High-intensity yoga exercise group (HY)	Moderate-intensity yoga exercise group (MY)	Sedentary control group (CON)
Gender (female n %)	4 (40%)	8 (80%)	4 (40%)
Age	50.6 ± 6.1	52.6 ± 6.1	52 ± 5.9
Race/Ethnicity			
Caucasian	5 (50%)	4 (40%)	8 (80%)
Hispanic	1 (10%)	3 (30%)	0 (0%)
Black	2 (20%)	1 (10%)	1(10%)
Asian	3 (30%)	2 (20%)	1 (10%)
Pacific islander	1(10%)	0 (0%)	0 (0%)
Other	1 (10%)	1 (10%)	0 (0%)
Education some college (n %)	9 (90%)	8 (80%)	10 (100%)
Alcohol (#drinks/week)	1.6 ± 1.8	0.8 ± 1.9	0.7 ± 1.6
BMI	23.4 ± 3.5	27.1 ± 2.5	27.1 ± 3.1

Table 2. Results for feasibility metric

Feasibility metrics	Results
% of eligible participants were enrolled	**55%**
# of months required to complete the recruitment	**11**
Retention rate (% participants completing 2 study visits)	**97%**
Completion rate of questionnaires	**99%**
Completeness of physiological measures (HR and blood)	**98%**
Adherence rate to the yoga exercise protocol	**88%**

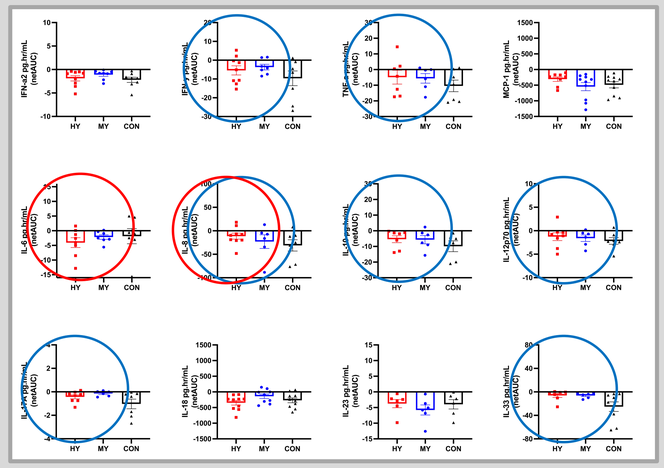


Figure 2. Bar graphs denote each group net area under the curve (netAUC) mean and SEM per cytokine. Red squares: HY; Blue circles: MY; Black triangles CON.
7 blue circles: 7 out 12 cytokines exhibited a magnitude of netAUC decrease for both yoga exercise groups smaller than control. **2 red circles:** The magnitude of decrease between the two intervention groups did not show any consistent response, except for IL-6 and IL-8

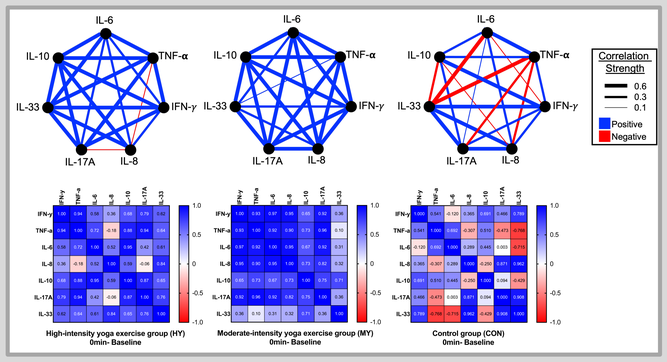


Figure 3. Delta correlations between the first time point after the intervention (0-minutes) and baseline. A— Positive (blue) and negative (red) correlations in which the width of the line represents the correlation strength. B— Heatmaps depict delta difference correlations between 7 cytokines in the HY; MY; and CON.
Across all groups changes are highly interdependent (between 0.3 and 0.6). HY and MY more positive correlations. CON more negative correlations

DISCUSSION

- Our findings support feasibility for the majority of evaluated criteria, which is noteworthy given that the study was conducted during the COVID-19 pandemic.
- Exploratory analyses, including visual plots of net area under the curve (netAUC) and correlation dynamics, identified IL-6 and IL-33 as the most informative cytokines, and thus good candidate markers for a future fully-powered trial.

This work was supported by T32 AT00051 from the NCCIH/NIH, K24AT009282 from NCCIH/NIH and K24AT009465 from NCCIH/NIH, and a pilot research grant from the Osher Center for Integrative Medicine.

HARVARD MEDICAL SCHOOL
Osher Center for Integrative Medicine
Beth Israel Deaconess Medical Center
BWH BRIGHAM AND WOMEN'S HOSPITAL