Impact of yoga exercise training on exercise enjoyment and compliance among previously sedentary, overweight adults.

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Abstract

Introduction: Nearly two-thirds of U.S. adults are classified as overweight or obese predisposing them to health problems including cardiovascular disease, type 2 diabetes, and certain types of cancer. Although exercise improves many factors for chronic disease, most U.S. adults do not meet current exercise guidelines. Low compliance with current exercise guidelines demonstrates a need for further methods of exercise to draw individuals to a physically active lifestyle. One method is yoga, a non-traditional form of exercise performed in hot or thermoneutral environments that has been shown to improve health markers and reduce chronic disease risk, yet compliance and enjoyment of these different forms of yoga exercise have not been examined. **Methods**: Using a randomized, crossover design, males (n=3) and females (n=11) completed an 8-week yoga training program (60 min/day, 3 days/week) in a thermo-neutral (22.1 ± 0.2 °C; humidity: 27.8% ± 1.6%) or hot environment (35.3 ± 0.8 °C; humidity: 20.5% ± 1.4%). Exercise compliance was recorded as an objective measure ([# of completed exercise sessions/24] x 100) and exercise enjoyment was assessed through the Physical Activity Enjoyment Scale (PACES). **Results:** Initial enrollment included 25 participants. However, 11 participants dropped out of the study including 7 from the hot group and 4 from the thermoneutral group. Compliance was similar between hot (83% ± 8%) and thermoneutral (84% ± 14%) groups. Participants reported a similar level of enjoyment between the hot vs. thermo-neutral yoga exercise sessions (80.2 ± 10.8 vs. 77.0 ± 4.7 PACES score, p=0.60) **Conclusion:** Both hot and thermoneutral yoga are equally effective at inducing compliance and enjoyment to exercise.

Introduction

- An obese body mass index (BMI) is associated with increased risk of chronic diseases including Type 2 diabetes, heart disease, and certain types of cancer [1].
- Regular aerobic exercise has been shown to improve many chronic disease risk factors, benefiting both blood pressure and insulin sensitivity [2].
- Despite benefits of aerobic exercise, most U.S. adults do not meet exercise guidelines, indicating a need for increased exercise compliance [3].
- Yoga is an increasingly popular method of aerobic exercise and has been shown to improve key health markers [4].
- A vital step in determining the efficacy of regular yoga exercise training for the prevention or treatment of chronic disease is the analysis of enjoyment and engagement in addition to potential health improvements.

Purpose

The purpose of this study was to evaluate the impact of hot and thermo-neutral yoga on exercise enjoyment and compliance.

Participants

Table 1. Baseline Participant Characteristics

	TN		H	
	Pre	Post	Pre	Post
Sex (M:F)	2:5	-	1:5	-
Age (years)	41.6 ± 9.4	-	45.0 ± 11.5	-
Height (cm)	170.2 ± 7.0	-	168.7 ± 11.0	-
Weight (kg)	103.3 ± 26.5	101.7 ± 25.3	92.0 ± 17.2	89.5 ± 19.1
Body Mass Index (kg/m2)	35.2 ± 6.5	34.8 ± 6.5	32.5 ± 6.7	33.1 ± 6.8
Percent Body Fat (%)	46.4 ± 3.9	45.2 ± 4.8	45.6 ± 6.2	47.4 ± 5.1
Lean Body Mass (kg)	54.1 ± 18.3	54.6 ± 19.1	48.6 ± 10.0	45.0 ± 6.4
Fat Mass (kg)	46.3 ± 8.8	44.4 ± 7.5	41.1 ± 11.1	41.3 ± 12.6

Data presented as mean ± SD.

Methods

Experimental Design

Study design: We used a randomized study design to examined the impact of 8 weeks of yoga exercise training performed in a hot ("H"; n=6) or thermoneutral ("TN"; n=7) environment on markers of health and fitness.

Participants: Included 13 male (n=3) and female (n=10) overweight, sedentary (i.e., did not regularly engage in planned physical activity/exercise), adults (age: 18-69). Participants were also weight stable (no change in body weight >5 pounds in the last 6 months) and non-smokers. Participants were excluded if they were pregnant or trying to become pregnant, had been previously diagnosed with diabetes (both type 1 and type 2), or had any pre-existing musculoskeletal conditions that would have prohibited them from engaging in regular yoga exercise.

All procedures were approved by the CMU IRB and written informed consent was obtained from all participants prior to data collection.

Exercise Intervention

Volume: 3 yoga sessions per week for 8 weeks

Routine: Instructor-led video designed to maintain exercise intensity throughout the yoga session based on previously collected data [5].

Environment: Room temperature was 70-80°F during TN sessions and heated to 95-100°F during H sessions. Temperature and humidity of the room were recorded before and after each yoga session.

Intensity: Heart rate (Polar H7 Heart Rate Sensor, Polar Electro and transmitted to a Polar watch (Polar A300, Polar Electro) and oxygen consumption (VO_2; COSMED K5 Wearable System, Rome, Italy) were measured during the first and last week of training to determine exercise intensity.

Outcome Measures

Cardiorespiratory fitness: was assessed through a graded exercise treadmill exercise test with collection of expired gases (COSMED K5 Wearable System, Rome, Italy) to determine peak oxygen consumption (VO_2peak; highest value recorded during the last minute of exercise).

Exercise Enjoyment: was measured through an 18-item Physical Activity Enjoyment Scale (PACES) questionnaire [6].

Compliance: was determined by the [# of completed exercise sessions/24] x 100.

Attendance: was recorded for each session and drop out rates were calculated based on the number of participants that terminated involvement in the study, compared to the overall participants in the study.

Statistical Analysis

A paired t test was used to assess potential differences in compliance and enjoyment of exercise between the 2 conditions (i.e., thermoneutral vs. hot). Statistical analyses were performed using Excel and all data are presented as mean ± SE. Statistical significance was set to $p < 0.05$.

Results

Table 2. Exercise Intensity

	H		TN	
	First week	Last week	First week	Last week
VO_2 (L/min)	1.0 ± 0.3	0.9 ± 0.2	1.2 ± 0.6	1.1 ± 0.2
%VO_{2peak} (%)	40.5 ± 9.2	42.6 ± 8.2	39.7 ± 9.1	42.5 ± 8.7
METs	2.9 ± 0.6	2.8 ± 0.6	3.1 ± 0.5	3.0 ± 0.4
Heart Rate (bpm)	121.5 ± 10.7	123.6 ± 9.9	124.0 ± 13.0	120.1 ± 8.3
%HRpeak (%)	69.0 ± 3.0	70.0 ± 4.0	69.0 ± 6.0	67.0 ± 4.0

Data presented as mean ± SD.

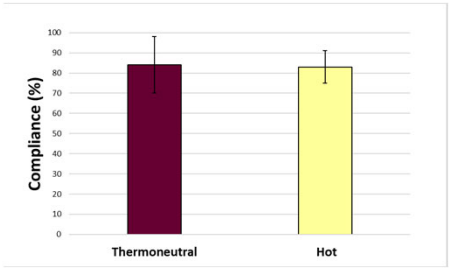

Figure 1. Compliance to 8-weeks of yoga exercise training performed in a thermoneutral environment (maroon bar) and hot (gold bar) environment.

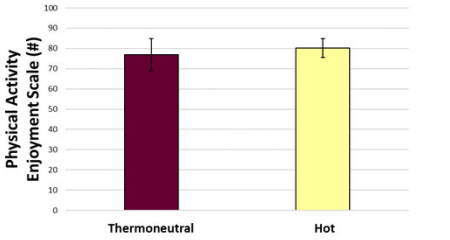

Figure 2. Physical Activity Enjoyment Scale (PACES) to 8-weeks of yoga exercise training performed in a thermoneutral environment (maroon bar) and hot (gold bar) environment.

Summary of Results

- Participant characteristics were similar between hot and thermoneutral groups at baseline (Table 1).
- There was no significant difference in exercise intensity between hot and thermoneutral groups. (Table 2).
- Initial enrollment included 25 participants. However, 11 participants dropped out of the study including 7 from the hot group and 4 from the thermoneutral group; drop out rate was 44%.
- Reasons for ending participation in the yoga study from the hot group included scheduling conflicts (n=1), previous chronic neck pain (n=1), BMI below study stipulations(n=1), lack of physician clearance for OGTT test (n=1), conflicts with exams (n=1), pandemic (n=1), and stress from changing job (n=1).
- Conversely, reasons participants dropped from the thermoneutral group included health issues from previous surgeries (n=1), broken foot (n=1), pandemic (n=1), and the difficulty of the yoga class (n=1).
- Compliance was also similar between hot vs. thermoneutral yoga exercise sessions (83% ± 8% vs. 84% ± 14%) (Figure 1).
- Participants reported a similar level of enjoyment between the hot vs. thermo-neutral yoga exercise sessions (80.2 ± 10.8 vs. 77.0 ± 4.7 PACES score, p=0.60) (Figure 2).

Discussion

- Reasons for dropping out of our yoga intervention were similar to those previously reported, but higher dropout rates are associated with home-based interventions [7].
- Overall compliance rates with our 8-week yoga exercise training program were high (>80%) and did not appear to be influenced by environment (hot vs. thermoneutral).
- Exercise enjoyment with our 8-week yoga exercise training was not influenced by environment (hot vs. thermoneutral). Interestingly, our 8-week yoga exercise training program resulted in higher physical activity enjoyment than Zumba [8] and lower than high intensity interval training [9] (additional novel exercise interventions).

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