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Original research

Effect of a 16-week Bikram yoga program on perceived stress, self-efficacy and health-related quality of life in stressed and sedentary adults: A randomised controlled trial

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ABSTRACT

Objectives: The purpose of this study was to investigate the effect of 16 weeks of Bikram yoga on perceived stress, self-efficacy and health related quality of life (HRQoL) in sedentary, stressed adults.

Design: 16 week, parallel-arm, randomised controlled trial with flexible dosing.

Methods: Physically inactive, stressed adults (37.2 ± 10.8 years) were randomised to Bikram yoga (three to five classes per week) or control (no treatment) group for 16 weeks. Outcome measures, collected via self-report, included perceived stress, general self-efficacy, and HRQoL. Outcomes were assessed at baseline, midpoint and completion.

Results: Individuals were randomised to the experimental ($n=29$) or control group ($n=34$). Average attendance in the experimental group was 27 ± 18 classes. Repeated measure analyses of variance (intention-to-treat) demonstrated significantly improved perceived stress ($p=0.003$, partial $\eta^2=0.109$), general self-efficacy ($p=0.034$, partial $\eta^2=0.056$), and the general health ($p=0.034$, partial $\eta^2=0.058$) and energy/fatigue ($p=0.019$, partial $\eta^2=0.066$) domains of HRQoL in the experimental group versus the control group. Attendance was significantly associated with reductions in perceived stress, and an increase in several domains of HRQoL.

Conclusions: 16 weeks of Bikram yoga significantly improved perceived stress, general self-efficacy and HRQoL in sedentary, stressed adults. Future research should consider ways to optimise adherence, and should investigate effects of Bikram yoga intervention in other populations at risk for stress-related illness.

Trial registration: Australia New Zealand Clinical Trials Registry ACTRN12616000867493. Registered 04 July 2016. URL: <http://www.anzctr.org.au/ACTRN12616000867493.aspx>.

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1. Introduction

Psychological stress arises when an individual perceives environmental demands to exceed his or her adaptive capacity. Stress can increase the risk of developing chronic conditions including cardiovascular disease (CVD) and metabolic disease.¹ In 2015, “health issues” were identified as a leading stressor for Australians, and two thirds of Australians believe that stress impacts physical and mental health status.² However, sedentary activities including watching television are more prevalent stress management

techniques despite being less effective than other constructive techniques such as physical activity.²

Physical activity is one of the more effective techniques to reduce psychological stress,² yet stress has been shown to contribute to lower engagement in exercise, particularly in sedentary individuals.³ Those without established exercise habits tend to decrease physical activity in response to stress compared to habitual exercisers, who are more likely to use exercise to manage stress.³ High stress is also associated with low self-efficacy,⁴ one’s belief in his or her abilities to achieve goals of importance, an attribute which contributes to exercise uptake and adherence.⁵ Low self-efficacy may also mediate other adverse psychological effects that arise from stress including depression.⁶ The inability to manage stress has been associated with lower health-related qual-

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ity of life (HRQoL) in apparently healthy and chronically diseased cohorts.^{7,8}

Bikram yoga is a specific system of *hatha* (physical) yoga characterised by a 90-min, unchanging sequence of *asanas* (postures) performed in a heated environment (40.6 °C, 40% humidity).⁹ This form of *hatha* yoga purports to induce significant health benefits, including improvements in physical fitness and some physiological and psychological parameters.^{10–12} Non-intention-to-treat Bikram yoga trials report within-group improvements in perceived stress in apparently healthy adults and stressed, disordered eaters,^{10,11} and improvements in specific domains of HRQoL.¹² Further to these findings, a recent systematic review noted that other forms of *hatha* yoga may improve mood and mediate the stress response.¹³ The independent effect of the Bikram yoga heated environment on psychological health is unclear. However, heat therapies including sauna bathing and sweat-practices are used across many cultures to promote well-being, induce relaxation and improve hyperactivity, mood and stress.¹⁴

No RCT to date has investigated the effect of Bikram yoga on self-efficacy in sedentary and stressed adults.¹⁰ Therefore, we hypothesised that participants randomised to 16-weeks of Bikram yoga intervention would significantly decrease perceived stress, increase general self-efficacy and improve all domains of HRQoL compared to participants randomised to a no-treatment control group.

2. Methods

This 16-week, parallel-arm RCT compared the outcomes of participants randomised to an experimental Bikram yoga group or a no-treatment control group. Outcomes were collected at baseline (week zero), midpoint (week eight) and following the intervention period (week 17). Ethics approval was granted by the University Human Research Ethics Committee, which conforms to the requirements stipulated in the Declaration of Helsinki. Written informed consent was obtained from all participants.

Eligibility criteria: (1) Adult (≥ 18 years); (2) sedentary (i.e. < 150 min of moderate-intensity exercise per week for more than six months); (3) a score > 14 on the stress component of the Depression, Anxiety and Stress Scale (DASS-21)¹⁵ indicating mild or greater stress; (4) no self-reported, diagnosed chronic diseases; (5) no acute or chronic medical condition that would make Bikram yoga potentially hazardous (e.g. pregnancy) or outcomes difficult to assess; (6) able to attend three to five Bikram yoga classes per week for 16 weeks; (7) cognition and English language sufficient to understand research procedures and provide informed consent; (8) no participation in Bikram yoga in the past six months.

Participants were recruited, screened and enrolled between August 2014 and September 2015. Details of recruitment, screening and enrolment are reported elsewhere. One trained researcher collected all baseline and completion outcome measures (week zero and 17) at the local university. Psychological questionnaires were self-administered within the testing appointment. Midpoint measures (week eight) were delivered via email and returned via email or in person. Data collection was completed in January 2016.

The sample size for this study is based on sample size calculations for a primary outcome reported in another paper using the same cohort, as previously reported. Participants were randomised via a computer-generated list stratified by sex and age (< 50 yr; ≥ 50 yr). An investigator not involved in testing or delivery of the intervention prepared the randomisation assignments. Group assignments were delivered to participants in person in sealed envelopes upon completion of baseline testing.

Participants in the experimental group engaged in 16-weeks of Bikram yoga classes at either of two affiliated Bikram yoga

studios. Participants were instructed to attend between three to five (participants' choice within that range) regularly scheduled classes per week. Certified Bikram yoga teachers instructed all classes using a set instructional dialogue. Each 90-min class was held in a temperature-controlled room (40.6 °C, 40% humidity). The class opened with a deep breathing exercise, and continued with 45–50 min of standing *asanas* and 40–45 min of floor-based *asanas*, including a quick, forceful breathing exercise to finish.⁹ All but the last *asana* (spine-twisting) were performed twice. *Savasana* (restorative, relaxation posture) was performed between *asanas* throughout the floor series and at the end of class.⁹

Participants in the control group were instructed to maintain current lifestyle practices and were not provided any information or instructions about Bikram yoga practice. However, participants were informed during recruitment and screening that control group participants would be provided a complimentary 10-class pass at one of the participating studios upon completion of the trial.

All instruments evaluating perceived stress, general self-efficacy and HRQoL were self-administered by participants in a quiet room. The 10-item Perceived Stress Scale (PSS) has been widely used and is a valid and reliable tool (internal consistency, i.e. Cronbach's $\alpha \geq 0.84$) to assess perceived stress in adults.¹⁶ Higher scores reflect higher stress. The 10-item General Self-Efficacy (GSE) scale has been shown to be a reliable construct (internal consistency, i.e. Cronbach's $\alpha = 0.75–0.91$) to measure general self-efficacy across different cultures.¹⁷ Higher scores reflect higher self-efficacy. Quality of life was assessed by the *RAND 36-Item Health Survey 1.0* (SF36), a measure that assesses eight domains of quality of life: physical functioning, bodily pain, role limitations due to physical health problems (physical role limitations), role limitations due to emotional problems (emotional role limitations), emotional well-being, social functioning, energy/fatigue, and general health. The SF36 is reliable, has construct validity and the domains have been shown to have acceptable internal consistency (Cronbach's $\alpha > 0.85$) in an apparently healthy population.¹⁸

Weekly status checks administered via phone, email or in person were used to check for major lifestyle changes and adverse events throughout the intervention period. Attendance in the experimental group was recorded electronically upon arrival at each respective studio via an online booking system managed by the staff member at reception. Attendance was reported as total number of sessions completed. Adverse events were defined as any injury that was directly attributable to the Bikram yoga intervention. Participants who experienced an adverse event were advised to visit a qualified health care practitioner for assessment and treatment.

Primary analysis was undertaken using intention-to-treat including all eligible participants regardless of dropout or level of adherence. Missing data at week 17 was imputed carrying the last observation forward. Missing data at week 8 was imputed carrying the last observation backward. Outcomes data is presented as the mean \pm standard deviation (SD) and effect size (partial eta-squared). Baseline characteristics were compared using t-tests and chi square tests. Intervention effects on outcome measures (group \times time) were examined via repeated measures analysis of variance or covariance (ANOVA or ANCOVA). Significance was interpreted using the Greenhouse-Geisser p-value, and post hoc ANCOVA was used to interpret statistically significant repeated measures ANOVA results, comparing between group changes from week zero to week eight and from week eight to week 17 with 95% confidence intervals (CI). Pearson's correlation coefficients (r) were used to examine baseline associations between all outcomes and descriptive variables, with p-values reported for the hypothesis testing that the correlation was equal to zero. Supplementary analyses of the effect of attendance on outcomes was conducted using the same repeated measures ANOVA and ANCOVA methods.

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