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Yoga for reducing perceived stress and back pain at work

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Background	Stress and back pain are two key factors leading to sickness absence at work. Recent research indicates that yoga can be effective for reducing perceived stress, alleviating back pain, and improving psychological well-being.
Aims	To determine the effectiveness of a yoga-based intervention for reducing perceived stress and back pain at work.
Methods	Participants were recruited from a British local government authority and randomized into a yoga group who received one 50 min Dru Yoga session each week for 8 weeks and a 20 min DVD for home practice and a control group who received no intervention. Baseline and end-programme measurements of self-reported stress, back pain and psychological well-being were assessed with the Perceived Stress Scale, Roland Morris Disability Questionnaire and the Positive and Negative Affect Scale.
Results	There were 37 participants in each group. Analysis of variance and multiple linear regression showed that in comparison to the control group, the yoga group reported significant reductions in perceived stress and back pain, and a substantial improvement in psychological well-being. When compared with the control group at the end of the programme, the yoga group scores were significantly lower for perceived stress, back pain, sadness and hostility, and substantially higher for feeling self-assured, attentive and serene.
Conclusions	The results indicate that a workplace yoga intervention can reduce perceived stress and back pain and improve psychological well-being. Larger randomized controlled trials are needed to determine the broader efficacy of yoga for improving workplace productivity and reducing sickness absence.
Key words	Back pain; occupational stress; physical activity; well-being; yoga.

Introduction

Stress and back pain are two major factors associated with sickness absence, which costs British industry an estimated £17 billion per year [1]. Although there are many environmental, psychological and physical determinants of sickness absence [2,3], the Health and Safety Executive reported that in 2011, 10.8 million working days were lost due to work-related stress, and 7.6 million working days were lost due to musculoskeletal disorders, of which 40% were related to back pain [4].

Research indicates that few workplace interventions have been effective in reducing stress and back pain [5]. Stress management programmes and cognitive behavioural therapy have been shown to be the most effective interventions for dealing with work-related stress [6], while workplace exercise programmes are best for preventing low back pain [7]. Workplace programmes of physical activity have also been shown to have a positive effect on the mental and physical health of employees [8].

Yoga is one form of physical activity that is increasingly being introduced in workplace settings to improve health and well-being [9]. Yoga is an ancient form of health promotion, involving physical activity, breathing exercises, relaxation techniques and meditation practices to enhance mindfulness and mind-body awareness [10]. Recent research suggests that yoga is effective for dealing with many chronic health conditions such as cardiovascular disease [11], diabetes [12], cancer [13],

anxiety/stress [14], migraine headaches [15] and chronic low back pain [16].

Although recent research suggests that yoga can be effective for reducing stress and back pain [14,16], only two randomized controlled trials have evaluated the effectiveness of yoga in the workplace for improving psychological well-being and reducing perceived stress in the workplace [17,18], and none have directly measured the effect of workplace yoga for alleviating back pain. The purpose of this pilot study was to measure the effect of a yoga-based programme for reducing perceived stress and back pain—two major causes of sickness absence in the workplace.

Methods

This study was conducted at a British local government authority (LGA), and used a randomized wait-list control design with ethical approval from Bangor University. In January/February 2011, employees, aged 25–64 years, were self-selected via information provided at four health promotion events within the LGA, and from e-mail announcements via the LGA's intranet. Interested employees were then e-mailed a 'participant information' sheet and a consent form. After reading the participant information sheet, employees were invited to sign the consent form and complete a baseline questionnaire consisting of four assessment scales, including a 20-item 'bothersomeness scale', the Perceived Stress Scale (PSS), the Roland Morris Disability Questionnaire (RMDQ) and the Positive and Negative Affect Scale (PANAS-X).

The 'bothersomeness scale' invited participants to identify any health concerns from a list of 20 common conditions (e.g. arthritis, asthma, back pain, depression, heart conditions, stress, etc) by rating the degree of bothersomeness on a scale of 1–4 (1 = 'not at all' bothersome; 4 = 'a lot' bothersome) [18]. Completed questionnaires were then assessed by a senior yoga instructor. Participants with 'at risk' health conditions (e.g. recent surgery, spinal disc problems, first trimester pregnancy, etc) were excluded from this study to ensure safe practice and prevent harm.

The baseline questionnaire also asked participants to indicate how often they currently practised yoga (or yoga-related activities such as Tai Chi or Pilates). To prevent bias, participants already practising yoga or yoga-related activities once per week or more were excluded from the analysis of this study, although they were allowed to participate in the classes.

Completed baseline questionnaires were assessed for perceived stress and back pain using the 'bothersomeness scale', which has been shown to have substantial construct validity [19]. Participants with bothersomeness scores of 2 or more for stress and/or back pain were stratified and randomized by the UK-registered Bangor Trials Unit (NWORTH) to ensure that both the yoga group and the control group had equal numbers of employees with stress and back pain (Figure 1).

The yoga group was then offered an 8 week programme of yoga classes at lunchtime and after work during March/April 2011. Participants in the yoga group were invited to attend one 50 min yoga class per week for 8 weeks. The content of the classes included activation exercises, energy block release movements, postures and relaxation (Table 1). Participants were also invited to practice at home at least twice per week using a 20 min DVD, which included activation exercises (4 min), energy block release movements (10 min) and a guided relaxation (4 min). All classes and DVDs were free of charge. Although participants in the control group received no intervention during the 8 week study period, they were offered an 8 week programme of yoga in May/June 2011.

Dru Yoga was the chosen intervention because it is a particularly safe and therapeutic form of yoga that can be practised by most people [20]. Dru Yoga is characterized by graceful movements, directed breathing and relaxation techniques that include affirmation and visualization. The Dru Yoga classes in this intervention were divided into four stages: activation exercises, energy block release sequences, postures and relaxation (Table 1).

Outcome measures for perceived stress (PSS), back pain (RMDQ), and psychological well-being (PANAS-X) were recorded from participants in both the yoga and control groups at 'baseline' (prior to beginning the programme) and at 'end programme' (8 weeks later). All three of these scales—PSS, RMDQ and PANAS-X—have demonstrated a strong degree of concurrent validity and internal reliability [21–23].

The PSS is a 10 item scale commonly used as a psychological instrument to measure the perception of stress. It measures the extent to which a person perceives life situations as stressful. It collects data on feelings and thoughts during the last month [21].

The RMDQ is a short 24-item questionnaire used for measuring the perceived change in function of people with lower back pain. The maximum score possible is 24; the higher the score, the greater the reported disability. Participants were asked to indicate which daily activities or functions were limited by back pain [22].

The PANAS-X scale is a 60-item questionnaire of positive and negative affect. It measures the extent to which an individual has experienced pleasurable and/or unpleasant feelings during the past week. A high positive affect (PA) indicates a feeling of enthusiasm or alertness, whereas feelings of lethargy or sadness could result in a low PA. Considered a reliable measure of emotional experience, the PANAS-X is well recognized in the field of clinical psychology [23].

General linear models were constructed to analyse differences between the yoga group and the control group at baseline and at end programme for the three domains

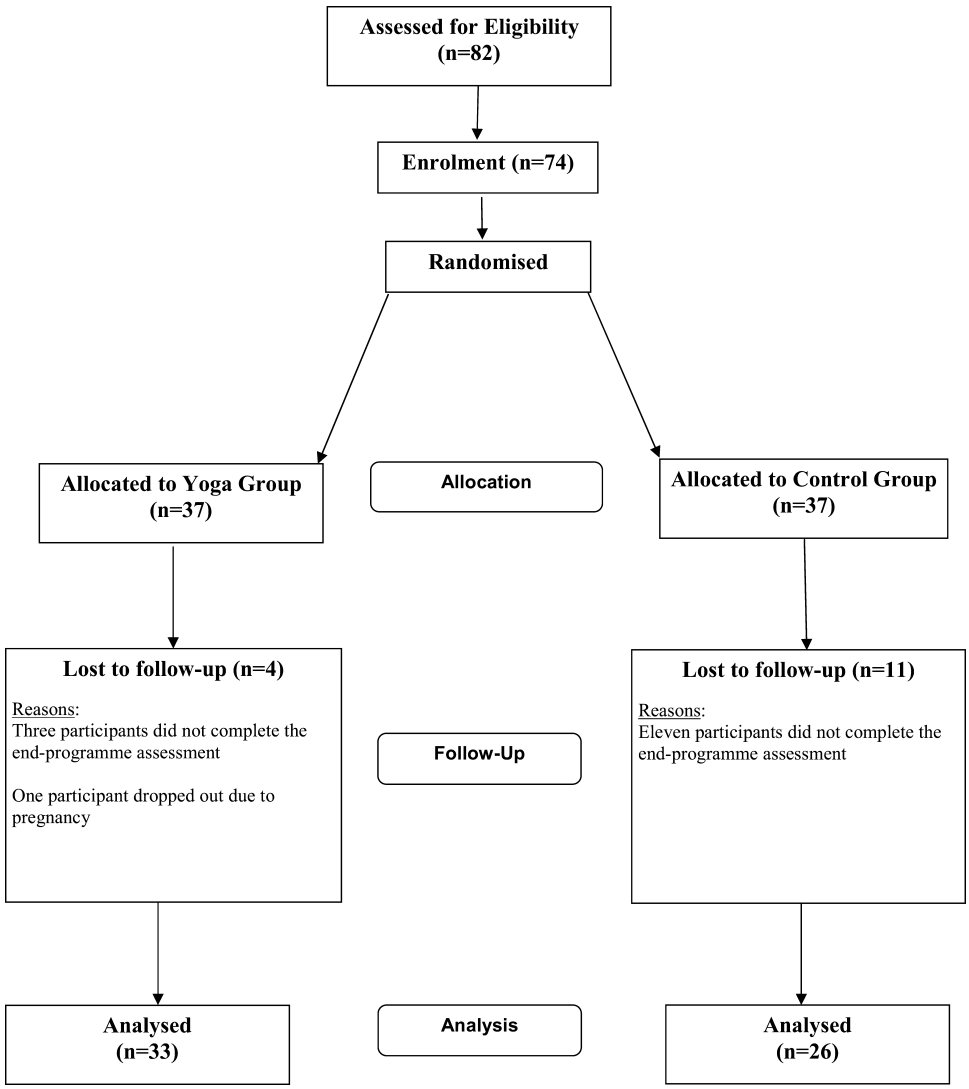

Figure 1. Participant flow diagram.

measured: stress, back pain and well-being. Statistical analysis was performed using the Statistical Package in the Social Sciences version 16 (SPSS Inc., Chicago, IL, USA).

Prior to analysis, all data were checked for homogeneity of variances and homogeneity of regression lines. Normality was examined using Q-Q plots and Box-plots. We used pairwise deletion to treat the very small number of missing values from each of the outcome measures. Using baseline scores as covariates, effects of the intervention were determined using analysis of variance (ANOVA), and multiple linear regression when appropriate, for end-programme scores of PSS, RMDQ and all 10 domains of PANAS-X. Significance was assessed

Table 1. Dru yoga intervention [19]

Activation exercises (10 min)	Flowing warm-up movements aimed at enhancing circulation, releasing tension and preparing the body for movement.
Energy block release movements (15 min)	A sequence of 12 movements including stretching, twisting, bending (forwards, backwards, and sideways), and squatting intended to increase circulation and 'energy flow', performed slowly with joints unlocked and slightly flexed, and the limbs and torso relaxed.
Postures (15 minutes)	Two postures chosen: the cat and the cobra. All postures were performed slowly with joints unlocked, with spinal wave and with conscious intention.
Relaxation (10 minutes)	Guided relaxation involved three parts: breathe and relax, visualize and affirm, and stretch and awaken. Activating the parasympathetic nervous system to achieve greater physical and emotional balance.

Table 2. Baseline characteristics of study participants

Demographic information	Yoga group (n = 33)	Control group (n = 26)
Mean age (SD)	46.1 (11.5)	43.6 (11.5)
Gender		
Women	29	24
Men	4	2
Occupation		
Local authority officers	19	13
Health/education/social care professionals	7	5
Managers	3	5
Admin. staff	4	3

SD, standard deviation.

at $P < 0.05$. The effect of the yoga intervention on all domains was corrected by using a false discovery rate (FDR) approach ($Q < 0.05$), which is reported to be more informative than the Bonferroni correction [24].

Results

Of the 82 employees selected to participate, 8 were excluded as they already practised yoga. Of the 74 participants, 59 (80%) completed both the baseline and end-programme questionnaires (33 in the yoga group and 26 in the control group). Of the 59 total respondents, the mean age was 44.8, and 90% were women. More than half of the participants (54%) were council officers; 20% were professionals in the sectors of health, education or social care, 14% were managers; and 12% were secretaries or administrators (Table 2). Baseline scores for perceived stress, back pain, and psychological well-being did not differ significantly between the yoga and control groups [t-test: PSS ($P = 0.35$); RMDQ ($P = 0.56$); and PANAS-X ($P = 0.31$)]. Unfortunately, we did not have access to information on absence rates during the programme.

Participants in the yoga group completed an average of six yoga classes and 15 home practice sessions during the 8 week study. The mean participation rate was 21 sessions (classes plus home practice) over the 8 week programme, equivalent to 2.6 yoga sessions per week.

ANOVA and multiple linear regression showed that in comparison to the control group, the yoga group at end programme reported significant reductions in perceived stress (PSS, $P < 0.01$; Figure 2, Table 3) and back pain (RMDQ, $P < 0.01$; Figure 3, Table 3), and a substantial improvement in psychological well-being (PANAS-X, $P < 0.001$; Table 3).

At baseline, back pain (RMDQ > 1) was reported by 10 participants in the yoga group and eight participants in the control group. At end programme, back pain was reported by only four participants in the yoga group and 13 in the control group. This resulted in an overall difference in mean RMDQ of 2.56 between the yoga group and control group at end programme.

Analysis of individual domains within the PANAS-X showed that in comparison with the control group, the yoga group at end programme reported significant improvements in feeling more serene ($P < 0.001$), self-assured ($P < 0.01$) and attentive ($P < 0.01$; Table 3). In addition, the yoga group reported significantly less hostility ($P < 0.001$) and sadness ($P < 0.01$) than the control group at end programme (Table 3). Although not statistically significant, the yoga group also reported feeling more jovial, and less fatigue, fear, shyness and guilt, in comparison to the control group at end programme (Table 3). In general, control group PANAS-X scores improved slightly over the course of the study, a result that may be due to general increases in emotional

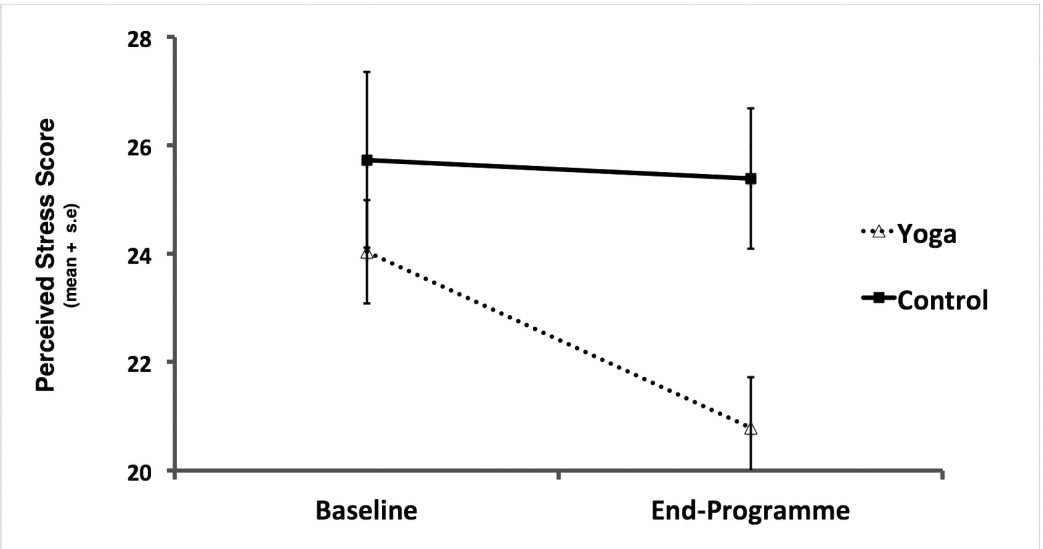

Figure 2. Mean PSS scores at baseline and end programme.

Table 3. Mean scores, *P*-values and *Q*-values from univariate ANOVA and multiple regression analysis of RMDQ, PSS and PANAS-X

Domains	Yoga (n = 33)		Control (n = 26)		*F*-ratio	*P*-value (unadjusted)	*Q*-value (adjusted)
	Baseline	End	Baseline	End		Yoga vs. control	Yoga vs. control
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)			
Back pain (RMDQ)	0.79 (0.32)	0.27 (0.15)	1.08 (0.37)	1.73 (0.51)	10.20	$P < 0.01$	$Q < 0.01$**
Perceived stress (PSS)	24.00 (0.95)	21.30 (0.93)	25.70 (1.62)	25.40 (1.30)	7.64	$P < 0.01$	$Q < 0.05$*
Well-being (PANAS-X)	210.20 (4.72)	233.40 (4.88)	203.10 (6.98)	205.80 (6.40)	15.40	$P < 0.001$	$Q < 0.01$**
1. Serenity	8.28 (0.43)	11.09 (0.40)	8.23 (0.55)	8.62 (0.49)	21.37	$P < 0.001$	$Q < 0.01$**
2. Reduced hostility	25.71 (0.63)	27.45 (0.43)	24.85 (0.94)	24.52 (0.88)	14.08	$P < 0.001$	$Q < 0.01$**
3. Self-assured	14.78 (0.71)	18.69 (0.84)	13.36 (1.02)	14.00 (1.00)	11.83	$P < 0.01$	$Q < 0.01$**
4. Reduced sadness	19.61 (0.72)	22.09 (0.60)	20.12 (1.01)	19.73 (1.01)	11.59	$P < 0.01$	$Q < 0.01$**
5. Attentiveness	11.97 (0.51)	13.84 (0.51)	11.77 (0.54)	12.12 (0.59)	7.26	$P < 0.01$	$Q < 0.05$*
6. Jovial	23.43 (1.01)	27.03 (1.13)	23.54 (1.13)	23.58 (1.11)	5.27	$P < 0.05$	NS
7. Reduced fatigue	12.78 (0.62)	15.50 (0.59)	12.50 (0.70)	13.69 (0.58)	4.65	$P < 0.05$	NS
8. Reduced fear	26.34 (0.71)	27.84 (0.49)	25.19 (1.07)	25.73 (1.01)	3.45	NS	NS
9. Reduced shyness	17.32 (0.46)	17.52 (0.43)	16.73 (0.75)	16.31 (0.82)	1.71	NS	NS
10. Reduced guilt	27.25 (0.60)	27.81 (0.52)	25.54 (0.88)	25.76 (0.94)	1.34	NS	NS

Significance values for each domain were determined after calculating the FDR corrections [24].

well-being as the seasons moved from late winter to early spring during the time period when our study occurred.

Discussion

The results of this trial showed that an 8 week programme of yoga resulted in significant reductions in stress and back pain, and improved psychological well-being, among a randomized group of adults employed at a British LGA. These results are consistent with the other published studies that show yoga to be effective for improving general health and well-being [25].

Only two randomized controlled trials have evaluated the effect of a yoga programme for improving health-related outcomes in the workplace. Hartfiel *et al.* reported that a 6 week yoga programme in a large British university (n = 48) resulted in a significant increase in resilience to stress, and substantial improvements in composure, clear-mindedness, elation, energy and confidence [17]. Wolever *et al.* found that a 12 week (12 h) yoga programme in large American insurance company (n = 239) produced significant improvements in perceived stress and sleep quality compared with a control group that received no intervention [18]. Neither the

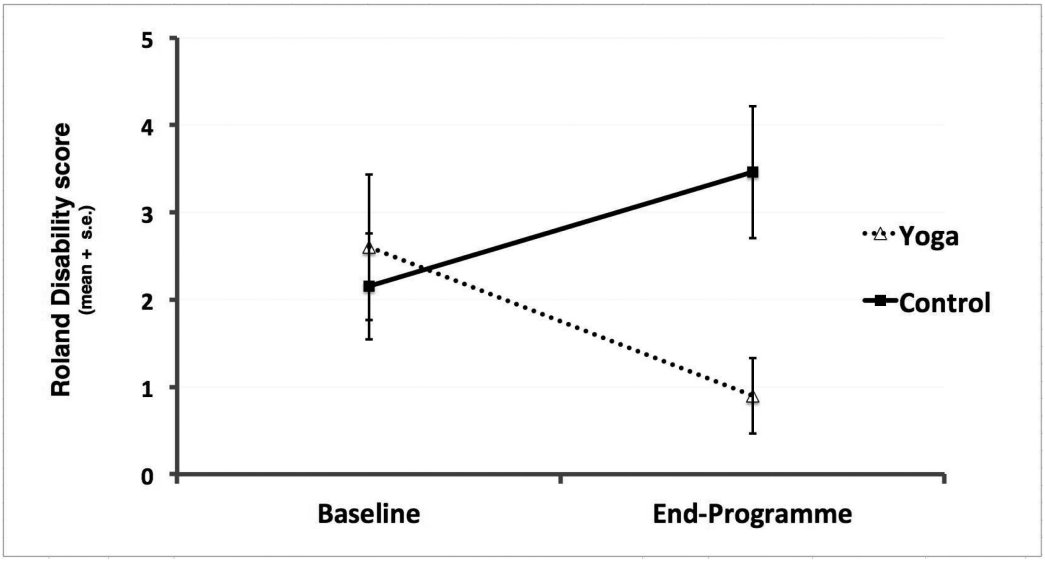

Figure 3. Mean RMDQ scores at baseline and end programme for all participants reporting back pain at some point during the programme.

Hartfiel study nor the Wolever trial measured the effect of yoga for reducing back pain in the workplace.

Other non-workplace yoga trials have confirmed the benefits of yoga for reducing stress and improving psychological well-being. Michalsen *et al.* reported that a 3 month yoga programme resulted in significant reductions in perceived stress among a randomized group of emotionally distressed women [26]. Both Vadiraja *et al.* [27] and Danhauer *et al.* [28] used the PANAS scale for measuring the effect of yoga on women with breast cancer. The Vadiraja study found that yoga had a significant overall positive affect, and the Danhauer trial reported substantial reductions in fatigue, fear and sadness in women with cancer who participated in a 10 week yoga programme.

Although there are no reported randomized controlled trials (RCTs) of yoga for reducing back pain in the workplace, recent research indicates that yoga is effective for reducing chronic low back pain [16]. Sherman *et al.* offered a 12 week programme of yoga to people with chronic low back pain (n = 228). The programme consisted of one 75 min class per week plus hand-outs and a yoga CD for home practice. This study found that the yoga group reported significant reductions in back pain over the 12 weeks, in comparison to a self-care book group [29]. Similarly, Tilbrook *et al.* also offered a 12 week yoga programme to people with chronic low back pain (n = 313). Classes were held on multiple sites throughout the UK. When compared with the control group that received a back pain education booklet, the yoga group reported significant reductions in back pain scores after 12 weeks [30].

Our study used a stratified randomized control design that permitted an objective assessment of the effects of an 8 week programme of yoga on perceived stress, back pain and psychological well-being. The lack of statistical differences at baseline in the domain scores between the yoga and control groups illustrates the benefits of this approach—subsequent differences at end programme between the two groups could be attributed to changes caused by the yoga programme.

The statistically significant changes in perceived stress, back pain and psychological well-being scores for the yoga group, relative to the control group at the end of the 8 week period, give clear support for our hypothesis that an 8 week workplace programme of yoga can be effective for reducing stress and back pain, and for enhancing psychological well-being.

Although our findings are promising, several factors limit the conclusions that can be drawn from our study. The size of our sample was modest (n = 82) in comparison with the other studies cited in this paper. Men were also underrepresented in our trial, comprising only 10% of the study participants.

Our sample was self-selected, and therefore it was representative of employees interested in workplace yoga. However, Hawthorne and/or placebo effects in the yoga group may have influenced the results. In addition, the observed improvement in domain scores for the yoga group (Table 3) may have been caused by such non-specific factors such as participation in a new group and the resulting group social support, positive interactions with the instructor and/or a high degree of participant effort and investment, as well as by the yoga intervention itself.

In addition, we placed no restrictions on the activities of either the yoga or the control groups during the intervention period, and we did not collect any data on treatment interventions received outside work. Thus, we cannot exclude the possibility that the (unregulated) activities of the participants during the study period influenced their end-programme scores.

The difference in dropout rates between the yoga group (11%) and the control group (30%) may have also influenced the results. Future studies may retain control group participants more successfully with appropriate remuneration for completion of outcome measures, which was not done in this study.

Finally, our study addressed only short-term changes: we did not determine whether an 8 week yoga programme could be effective for long-term improvements in stress management, reduced back pain and improved emotional well-being. Monthly follow-up sessions to monitor on-going home practice could be implemented in the workplace to measure the longer term effects of yoga for improving workplace health.

Despite these limitations, our overall results are significant and positive. Participants reported less perceived stress, reduced back pain, more serenity and improved self-assuredness. The results of this pilot study may provide a foundation for larger cost-effectiveness trials of yoga-based programmes in the workplace, which could result in the twin benefits of substantial savings for employers and health improvements for employees.

Future studies should collect data on absence rates and include an economic evaluation to determine the cost-effectiveness of yoga-based programmes at work. Integrating yoga into the workplace, at lunchtime or after work, may provide a time-effective, convenient and practical method for reducing the costly effects of stress and back pain.

Key points

- Stress and back pain are key issues in the workplace, resulting in unnecessary levels of sickness absence.
- Yoga-based programmes can be effective for reducing perceived stress and back pain, and for improving emotional well-being in the workplace.
- Organizations concerned about the health and well-being of their employees should consider offering a yoga programme at or near their workplace.

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Conflicts of interest

None declared.

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