Research Article

An 8-week Stress Management Program in Information Technology Professionals and the Role of a New Cognitive Behavioral Method: a Pilot Randomized Controlled Trial

Evangelia K Sioula[1], Xanthi Tigani[1], Artemios K Artemiadis[1,2], Dimitrios Vlachakis[3,4], George P. Chrousos[1,5], Christina Darviri[1*] and Evangelos C. Alexopoulos[1,6*]

[1]Postgraduate Course Stress Management and Health Promotion, School of Medicine, National and Kapodistrian University of Athens, 4 Soranou Ephessiou Str., 11527, Athens, Greece
[2]Medical School, University of Cyprus, Nicosia, 2029, Cyprus
[3]Division of Endocrinology and Metabolism, Biomedical Research Foundation of the Academy of Athens, Athens 11527, Greece;
[4]Laboratory of Genetics, Department of Biotechnology, School of Food, Biotechnology and Development, Agricultural University of Athens, 75 Iera Odos, 11855, Athens, Greece
[5]First Department of Pediatrics, Children's Hospital Aghia Sofia, School of Medicine, University of Athens, 1 Thivon Str., 11527, Athens, Greece
[6]Occupational Health Department, Metropolitan General Hospital, 15562 Athens, Greece

*Equal contribution

Received on October 31, 2019; Accepted on December 24, 2019; Published on December 30, 2020

Correspondence should be addressed to Christina Darviri; Tel: +30 2106597644; Email: cdarviri@yahoo.com

Abstract

Aim: The aim of this study is to compare and evaluate the sort-term benefits of the effects of an 8-week stress management techniques in information technology professionals. Methods: In this parallel randomized controlled trial, participants were randomly assigned to either the stress management group (n=40; relaxation breathing, progressive muscle relaxation, guided imagery) or in the Pythagorean Self awareness group (n=41). Self-reported validated measures were used to evaluate perceived stress, health locus of control, anxiety and depression. Results: All groups were found with significantly better cognitive speed and verbal memory at the end of the follow-up. Taking into account the group by time interaction coefficients, PSAT was found significantly superior to standard SM with regards to depression, emotional intelligence, lifestyle and personal control and verbal memory suggesting that verbal memory improvement through time should be mostly attributed to PSAT. On the other hand, the cognitive speed improvement during follow-up should be attributed to both interventions. Conclusions: These findings provide important insight into the role of stress management. Future studies should focus on randomized, controlled trials with larger samples and longer follow-up times.

Introduction

Work stress had been attested with numerous repercussions on mental health (Bhui *et al*. 2012). Chronic fatigue, absenteeism, burn-out, cognitive dysfunction, depression, cardiovascular diseases and disrupted immune responses are only few of the work stress-related problems. (Alexopoulos *et al*. 2015, Huang *et al*. 2015, Griep *et al*. 2015, Pederson *et al*. 2015, Padma *et al*. 2015, Alosaimi *et al*. 2015, Ninaus *et al*. 2015, Blix *et al*. 2013). Work stress has been ascribed mainly to the imbalance between work demands, control, and reward (Rabe *et al*. 2012). In the context of increased demands and decreased control or reward, excessive work strain ensues and leads to maladaptive behaviors such as alcohol/drug use, denial, disengagement, venting, and self-blame that may further precipitate work-related health problems (Rao & Channdraiah 2012).

Worksite studies target a variety of stress management techniques. Mind-body approaches

include various forms of meditation, progressive muscle relaxation, breathing exercises, yoga, biofeedback, guided imagery and mindfulness (Dusek *et al*. 2008, Klatt *et al*. 2015). The combination of two or more techniques has been proved to be of most benefit (Murphy 1996). In addition, simple relaxation training which includes diaphragmatic breathing and progressive muscle relaxation has been found beneficial for employees (Alexopoulos *et al*. 2014). In a meta-analysis of workplace stress interventions Cognitive Behavioral Therapy (CBT) has been found as the most effective and produce larger effects while relaxation interventions were most frequently used (Bhui *et al*. 2012, Hofmann *et al*. 2012, Richardson & Rothstein 2008). Mindfulness and meditation interventions as complementary therapies may be helpful in improving health and work performance (Ravalier *et al*. 2016). Tertiary interventions that are focused on work, such as exposure therapy and CBT interventions were found to improve symptomatology of depression and anxiety. (Joyce *et al*. 2016). However, CBT is time and money consuming hampering its appliance on a large scale.

In this randomized controlled study, we investigated the role of a novel cognitive stress management technique (i.e. Pythagorean Self-Awareness Intervention, PSAI) compared to other swell-known stress management interventions in a sample of workers in the private sector. PSAI, as described below, is a cognitive technique that, unlike CBT, requires a short period of education and permits the individual to perform the technique at home without the presence of a health professional.

Materials and Methods

Design of the study

This was a pilot non-blind randomized controlled trial (RCT), comparing two intervention groups, which will be educated in certain relaxation techniques and in a new cognitive-based technique within a stress management and healthy lifestyle program for 8 weeks. This study was conducted in Athens, from May 2016 to July 2016.

Participants and Procedure

The study was conducted in an information technology industry from May 2016 until July 2016 after the approval of the Human Resourced Department. All employees were invited to participate in the program. The only exclusion criteria

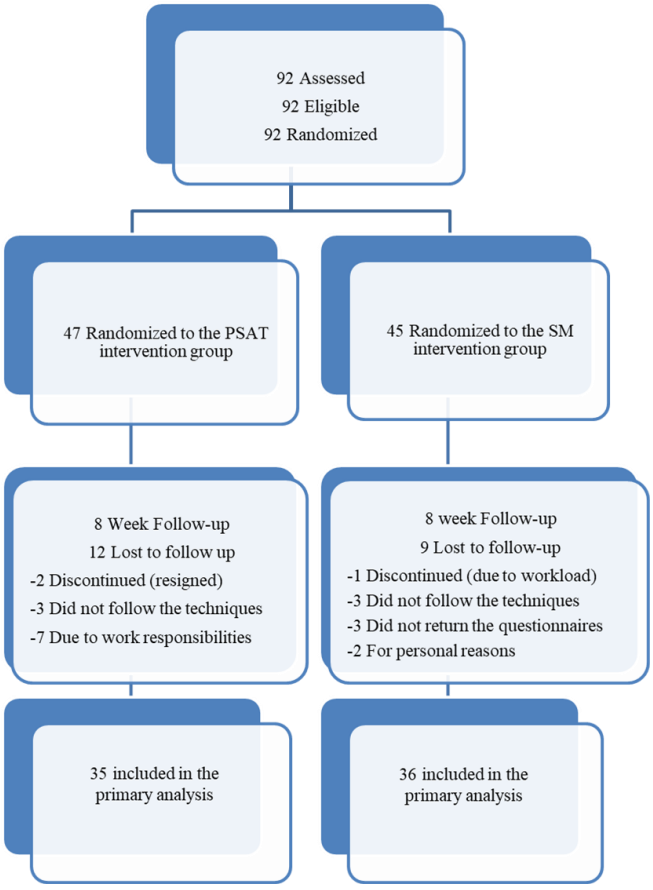

Figure 1. Flow diagram.

were participating in psychotherapeutic or other stress management therapies and the use of any psychotropic medication. Of the 92 employees who were initially willing to participate in the research and accepted to be randomized, 71 completed the stress management program (Figure 1). The loss of participants was due to either their increased work load or the fact that they had difficulties because of that in complying with the program (could not do the techniques).

Eligible participants were randomized to two intervention groups, the Pythagorean Self awareness group (PSAT) and the Stress Management group (SM), using random numbers generated by an on-line generator (www.random.org). At baseline, both groups were assessed by standardized questionnaires, and gave their written informed consent. Both groups were given a theoretical approach and participated in a biofeedback-assisted diaphragmatic breathing training. The participants were further instructed on implementing the relaxation techniques twice a day for 20 minutes with the help of an educational audio CD. In addition, they were given a diary to note how often they practice the techniques. Besides that,

both groups completed the cognitive tests. Additionally, both groups attended an informative session on stress in order to understand stress physiology and pathophysiology including guidance on diet, physical exercise and sleep. All participants could join the sessions or could attend via a web-based format at the same time.

Both groups were given a theoretical and practical approach towards understanding the techniques. In the second week the SM participants were instructed on progressive muscle relaxation technique and were further instructed on implementing the technique twice a day for 20 minutes with the help of an educational audio CD. In the next group sessions, a repeated lecture of the techniques was given, a lecture about cognitive restructuring and an instruction of guided imagery with the help of an audio CD.

The PSAT participants were instructed on the technique the second week. They were asked to perform the technique two times per day (morning and bedtime) after five minutes of diaphragmatic breathing. The technique's content is based on the golden verses of Pythagoras, which serves as a frame of reference for one's actions. In the next group sessions, lectures about memory, lifestyle, and interpersonal relationship, were given along with the Pythagorean Philosophy. During the last week discussion about the technique and final assessments were held. The PSAT was practiced twice per day (in the morning and at bedtime) in a quiet place. At night each individual had to follow three cognitive processes. First, the individual had to recall every event throughout the day in the exact time sequent that it happened. To facilitate recall events were categorized in diet, exercise, sleep and personal contacts. Secondly, he/she had to focus on the most important events of the day. During the last process he/she had to remain detached from the emotional burden of the event and contemplate on the performed actions as if he/she were a 'judge' of himself or herself. After this cognitive process, the individual was asked to set specific goals for the day to come.

Baseline and Outcome Measures

Socio-demographic variables. These variables included age, gender, marital and educational status.

Healthy Lifestyle and Personal Control Questionnaire (HLPCQ). The questionnaire of measurement of everyday life, lifestyle and health includes questions relating to the characteristics of sleep, eating habits, medical history, general health status, exercise and a list of various stress symptoms. This list does not constitute a psychometric tool. It consists of various symptoms associated in some degree with stress (Darviri *et al*. 2014).

Perceived Stress Scale. The Perceived Stress Scale (PSS) is a self-reported 14-item measure of the degree to which situations in an individual's life are appraised as stressful. (Cohen *et al*. 1983). For this purpose, respondents rated the frequency of their feelings and thoughts over the previous month in a 5-point Likert-type scale (from 0=never to 4=very often). There are seven positive and seven negative items and the total score was calculated by summing up each score after reversing all the positive items. Higher scores indicate the higher level of perceived stress by the individual during the last month. The PSS measurement was performed at the beginning of the trial and the end of 8 weeks of follow-up. Good psychometric properties of this measure within the Greek population have been recorded (Andreou *et al*. 2011).

Health Locus of Control Scale. HLC was measured using the 18-item HLC scale developed by Wallston, Wallston and De Vellis (1978). The respondents expressed their level of agreement to 18 statements in a 6-point Likert-type scale (from 1=strongly disagree to 6= strongly agree). The scale is built upon three 6-item subscales, namely 'internal HLC' (HLC1), 'external HLC' (HLC2) and 'chance' (HLC3). The internal HLC (HLC1) measures the degree in which the individual believes that he/she is responsible for his/her health status. The external HLC (HLC2) and chance (HLC3) represent the extent in which other people (such as medical doctors) or chance, respectively, are perceived by individuals as the main health determinants. After summing up answers for each subscale, higher scores indicate higher strength of each type of health belief (total score range from 6 -36 for each subscale). HLC measurements were made at baseline and at the end of 8 weeks. The instrument has been standardized for Greek populations (Karademas 2009).

Depression Anxiety Stress Scale (DASS-21). Depression, anxiety and stress were measured using the corresponding 7 items of the DASS-21 (Lovibond & Lovibind 1995). The respondents indicated the frequency of symptoms in a Likert-type scale (from 0=did not apply to me at all to 7=applied to me very much or most of the time) during the past week. Scores are produced by summing all items. Higher scores indicate higher

levels of depression, anxiety and stress. The scale has adapted to the Greek population (Lyrakos *et al*. 2011).

Wong & Law Emotional Intelligence Scale (WEIS). The scale is built upon four 16-item dimensions of emotional intelligence. The respondents expressed their level of agreement in a 7-point Likert-type scale (from 0=strongly disagree to 7=strongly agree) (Wong & Law 2002).

State Shame and Guilt Scale (SSGS): Shame, guilt and pride were measured using the 15 items of the scale. The respondents expressed their level of agreement in a 5-point Likert-type scale (from 1=strongly disagree to 5=strongly agree) (Marschall *et al*. 1994).

General Self-Efficacy Scale. The General Self efficacy scale is a 10-item measure that evaluates the positive beliefs in confronting difficulties during lifetime. The respondent expressed their level of agreement and disagreement in a 4-item Likert type scale. (1=no true at all, 2=less true, 3=enough true, 4=absolutely true) (Glynou *et al*. 1994).

Greek Pittsburgh Sleep Quality Index (GR-PSQI). The respondents indicated in a 9-item their habits of sleep during the last thirty days (Kotronoulas *et al*. 2010) .

Symbol Digit Modalities Test (SDMT). This test is widely used for the evaluation of information processing speed (Langdon *et al*. 2012, Sheridan *et al*. 2006). It consists of nine symbols that correspond to nine numbers (from 1 to 9). The responder was presented with a set of pseudo-randomized sequences of symbols and asked to verbally indicate the corresponding numbers in 90 seconds. The score indicates the number of correct responses during this time period.

California Verbal Learning Test-II (CVLT-II). This test evaluates immediate verbal learning and memory by asking the individuals to recall as many words as possible of a total of sixteen words (conceptually belonging in four categories; four words in each category) which are read by the examiner (Langdon *et al*. 2012, Stegen *et al*. 2010). The process is repeated five times, and the total score is determined by the total number of correct recalls (maximum 80).

Brief Visuospatial Memory Test-Revised (BVMT-R). This test evaluates visuospatial memory (Langdon *et al*. 2012, Benedict, 1997). The individual was presented with a matrix of six items in two columns and three rows for ten seconds, and he/she was asked to replicate the matrix unaided using pencil and paper while taking as much time as needed. The process was repeated three times. Each drawing was evaluated for both its placement (1 point) and its accuracy (1 point). Thus, the maximum score yielded by the three trials was 36, indicating unimpaired visuospatial direct memory recall.

Statistical Analysis

Baseline demographical and outcome data were presented as means, standard deviations (SD), or frequencies within groups. Between group comparisons for baseline data were performed by using Pearson's chi-square and Student's t tests for categorical and interval characteristics, respectively (Table 1 and 2). All analyses were performed in line with the intention-to-treat principle using the last observation carried forward method (LOCF).

Longitudinal changes in outcome measures from baseline to 8 weeks (or rate of outcome change) were analyzed using linear mixed-effects models with interaction terms for study group and time points. Random intercepts were used for the random effect of each participant in the model using variance components structure. The models' formula was the following:

$$Y_{ti} = b_0 + b_1(TIME_{ti}) + b_2(GROUP_i) + b_3(GROUP_i)\times(TIME_{ti}) + b'_0 + e_{ti}$$

, where Y_{ti} is the outcome, b_0 is the intercept, b_1, b_2 and b_3 are the fixed coefficients, b'_0 is the random coefficient for intercept, $TIME_{ti}$ is the time point (t) for each individual (i), $GROUP_i$ is the intervention condition and e_{ti} is the time specific residual of the model. The H_0 null hypothesis of interest was $b_3=0$. By coding the stress management (SM) group and baseline time as zeros (intervention and follow-up time as one) b3 represents the difference of the average rate of outcome of the PSAT group relative to the SM group. All analyses were performed using SPSS 22.0v for Windows (Chicago IL).

Results

Table 1 presents the demographics of our sample. Most were of young to middle aged, gender was equally represented in both groups, most were unmarried and all were of tertiary education. No statistically significant group differences were noted. Table 2 presents baseline measurements for all the outcomes' scores. There were no significant differences between study groups at baseline. Table 3 presents the results of the mixed-effects models.

Table 1. Baseline demographic characteristics (n=81)

Characteristic	PSAT group (N=41)	SM group (N=40)	p value
Mean age ± SD[1]	34.9 ± 5.8	35.8 ± 6.1	0.51
Men, N (%)	20 (48.8)	22 (55)	0.74
Married, N (%)[2]	15 (36.6)	18 (45)	0.59
Tertiary education, N, (%)[2]	41 (100)	40 (100)	1.0

SD: Standard Deviation, [1] Student's t-test, [2] Chi-square test

Table 2. Baseline outcome characteristics (n=81)[1]

Characteristic	PSAT group (N=41)	SM group (N=40)	p value
Mean BMI ± SD (Kg/m2)	24.3 ± 4.2	24.8 ± 4.1	0.66
Mean Stress ± SD	9.1 ± 7.3	8.5 ± 6.2	0.69
Mean Anxiety ± SD	13.0 ± 7.6	12.8 ± 6.8	0.89
Mean Depression ± SD	12.5 ± 8.1	10.6 ± 6.3	0.24
Mean internal HLC ± SD	26.1 ± 4.6	26.1 ± 4.2	0.98
Mean chance HLC ± SD	14.6 ± 4.3	15.2 ± 4.6	0.59
Mean powerful others HLC ± SD	18.9 ± 4.3	18.7 ± 3.9	0.83
Mean Emotional Intelligence ± SD	79.3 ± 10.2	82.2 ± 10.0	0.19
Mean Shame ± SD	9.2 ± 3.5	8.5 ± 3.3	0.32
Mean Guilt ± SD	12.2 ± 4.6	12.5 ± 4.9	0.83
Mean Pride ± SD	18.2 ± 3.8	19.6 ± 3.6	0.07
Mean Self-Efficacy ± SD	28.4 ± 3.7	29.3 ± 3.1	0.23
Mean HLPCQ ± SD	63.5 ± 11.0	65.8 ± 10.0	0.34
Mean Speed ± SD (secs)	55.8 ± 26.5	50.0 ± 25.3	0.32
Mean Three words ± SD	2.8 ± 0.4	2.7 ± 0.6	0.48
Mean Physical Fatigue ± SD (cm)	5.2 ± 2.4	5.8 ± 2.2	0.28
Mean Cognitive Fatigue ± SD (cm)	6.0 ± 2.4	5.6 ± 2.0	0.36
Mean Mental Fatigue ± SD (cm)	6.2 ± 2.0	6.0 ± 2.2	0.67
Mean SDMT ± SD	48.1 ± 14.8	49.3 ± 15.4	0.72
Mean CVLT-II ± SD	65.3 ± 9.4	64.5 ± 8.2	0.68
Mean BVMT-R ± SD	29.5 ± 4.5	30.8 ± 4.7	0.21
Mean SDNN ± SD	77.9 ± 38.1	75.9 ± 45.7	0.83
Mean RMSSD ± SD	60.7 ± 35.6	62.2 ± 56.9	0.88

BMI: Body Mass Index, HLC: Health Locus of Control, HLPCQ: Healthy Lifestyle and Personal Control Questionnaire, SDMT: Symbol Digit Modalities Test, CVLT-II: California Verbal Learning Test-2nd Edition, BVMT-R: Brief Visuospatial Memory Test Revised, SDNN: Standard Deviation of NN intervals, RMSSD: Root Mean Square of Successive Differences, SD: Standard Deviation, [1]Student's t-test

No significant group effects were noted. All groups were found with significant better cognitive speed (-0.3 ± 0.6, p=0.002) and verbal memory (2.8 ± 1.3, p=0.04) at the end of the follow-up. Taking into account the group by time interaction coefficients, PSAT was found significantly superior to standard SM with regards to depression (-2.4 ± 1.1, p=0.04), emotional intelligence (3.3 ± 1.6, p=0.05), lifestyle and personal control (2.9 ± 0.6, p=0.001) and verbal memory (4.0 ± 1.9, p=0.04) suggesting that verbal memory improvement through time should be mostly attributed to PSAT. On the other hand, cognitive speed improvement during follow-up should be attributed to both interventions.

Discussion

The aim of this study was to assess the effectiveness of a stress management and health promotion programme in a group of healthy employees. This article describes the development and the design of an intervention study which aims mainly to reduce employees' stress. Pythagorean self-awareness (PSAT) is a newly introduced intervention and for that reason the direct comparison with Stress Management (SM), which is also a non-pharmaceutical intervention, provides us better evaluation of the effectiveness of the techniques. In this study, PSAT had more beneficial effects on the physical, mental and psychological wellbeing of the employees of our sample compared to the SM group.

A central feature of PSAT was stress management. We believe that stress management was accomplished by both the diaphragmatic breathing and the daily events' cognitive appraisal. PSAT was found significantly superior to standard SM regarding depression, emotional intelligence, lifestyle and personal control. One possible explanation could be that PSAT, via cognitive appraisal may strengthen the perception of self-management and self-awareness, resulting in strengthening the personal traits that can be related to coping behavior. According to the stress diathesis model the effect of stressors on illness and wellness is not absolute but a function of moderating factors like inner strength and coping techniques. More importantly, positive coping strategies (POS) are assumed to reduce stress; they can be further separated into three subcategories, devaluation/

Table 3. Results of the Linear Mixed-Effects Models with Random Intercepts for the Rates of Outcome Change

Characteristic	b for group ± SE	p value	b for time ± SE	p value	b for group × time interaction with SM group as a reference[1] ±SE	p value
BMI (Kg/m2)	-0.4 ± 0.9	0.66	-0.1 ± 0.1	0.16	-0.03 ± 0.1	0.82
Stress	0.6 ± 1.5	0.68	-0.9 ± 0.8	0.28	-1.6 ± 1.1	0.15
Anxiety	0.2 ± 1.6	0.89	-0.8 ± 0.9	0.37	-2.2 ± 1.2	0.08
Depression	1.9 ± 1.5	0.21	-0.9 ± 0.8	0.25	-2.4 ± 1.1	0.04*
Internal HLC	0.0 ± 1.0	0.98	-0.7 ± 0.5	0.11	0.8 ± 0.6	0.24
Chance HLC	-0.5 ± 1.0	0.59	-0.7 ± 0.6	0.23	0.4 ± 0.8	0.64
Powerful others HLC	-0.1 ± 1.0	0.91	0.4 ± 0.6	0.53	0.7 ± 0.8	0.39
Emotional Intelligence	-3.0 ± 2.2	0.19	-0.1 ± 1.2	0.91	3.3 ± 1.6	0.05*
Shame	0.8 ± 0.7	0.29	-0.5 ± 0.4	0.22	0.0 ± 0.5	0.95
Guilt	-0.2 ± 1.0	0.82	-0.7 ± 0.6	0.27	0.1 ± 0.9	0.89
Pride	-1.3 ± 0.7	0.07	-0.3 ± 0.4	0.52	0.7 ± 0.5	0.18
Self-Efficacy	-0.9 ± 0.8	0.25	0.6 ± 0.4	0.15	1.0 ± 0.5	0.07
HLPCQ	-1.6 ± 2.4	0.50	-0.3 ± 0.6	0.68	2.9 ± 0.6	0.001*
Speed (secs)	5.8 ± 5.3	0.28	-7.0 ± 2.2	0.002*	-0.4 ± 3.0	0.89
Three words	0.1 ± 0.1	0.45	0.1 ± 0.1	0.54	0.0 ± 0.1	0.99
Physical Fatigue (cm)	-0.6 ± 0.5	0.29	0.3 ± 0.4	0.54	0.0 ± 0.6	0.98
Cognitive Fatigue (cm)	0.5 ± 0.5	0.36	0.1 ± 0.4	0.90	-0.7 ± 0.6	0.21
Mental Fatigue (cm)	0.2 ± 0.5	0.70	-0.1 ± 0.5	0.91	-1.1 ± 0.6	0.08
SDMT	-1.2 ± 3.2	0.70	-0.3 ± 1.4	0.82	0.6 ± 1.9	0.77
CVLT-II	0.8 ± 1.9	0.66	2.8 ± 1.3	0.04*	4.0 ± 1.9	0.04*
BVMT-R	-1.3 ± 1.1	0.23	-0.8 ± 0.7	0.25	1.7 ± 1.0	0.10
SDNN	2.0 ± 10.4	0.85	9.2 ± 10.0	0.36	-9.0 ± 14.0	0.52
RMSSD	-1.6 ± 12.4	0.90	6.8 ± 12.5	0.59	-4.4 ± 17.5	0.80

BMI: Body Mass Index, HLC: Health Locus of Control, HLPCQ: Healthy Lifestyle and Personal Control Questionnaire, SDMT: Symbol Digit Modalities Test, CVLT-II: California Verbal Learning Test-2nd Edition, BVMT-R: Brief Visuospatial Memory Test Revised, SDNN: Standard Deviation of NN intervals, RMSSD: Root Mean Square of Successive Differences, SD: Standard Deviation, SE: Standard Error,

[1]Reference categories: both stress management group and baseline time were coded as zeros in the model, thus b represents the mean rate of outcome change for the Pythagorean Self-Awareness group.

*p<0.05

defense, distraction and control. (Harzer & Ruch 2015). We could suggest that PSAT is more correlated with devaluation and control, while SM is more correlated with distraction coping strategy. Devaluation and defense cover a cognitive way of coping and entail the coping modes' minimization of intensity, duration and importance of stress while control entails analyze, plan and act for control and problem-solving. Control is also relating to the Conservation of Resources Theory as it has the potential to rebuild depleted resources (De Bloom *et al*. 2014). On the other hand, distraction entails relaxation and self-affirmation.

As far as depression is concerned, it is well established that depression is associated with stress and cognitive impairments that may impact work productivity. Different cognitive domains may be impaired in depression and include attention, memory, psychomotor speed and executive functions. Cognitive impairments may translate to workplace limitations, such as reduced productivity, increased work errors, increased risk of injury, inability to meet required deadlines and reduced ability to cope with stress (Lawrence *et al*. 2013). The results derived from the implementation seemed that PSAT was found significantly superior to standard SM with regards to depression and verbal memory while cognitive speed improvement during follow-up should be attributed to both interventions. PSAT fosters a more realistic view of the individual's actions and thoughts through cognitive appraisal and could contribute to a positive self-image; on the other hand the element of setting specific goals every day could be beneficial for detaining or even ameliorating the individual's cognitive deficits (Darviri *et al*. 2016). The employee becomes an active participant in a collaborative problem-solving process to test and challenge the validity of maladaptive cognitions and modify maladaptive behavioral patterns, which contribute to the maintenance of emotional distress and behavioral problems. PSAT could be considered an inclusive meta-cognitive process of stress management that has close resemblance to CBT but is accompanied by a deeper philosophical reflection (Darviri *et al*. 2016).

Our intervention seems quite promising also in improving future individual's emotional intelligence. It is well documented that cognitive intelligence is positively associated with job performance, and non-cognitive factors like emotional intelligence have been linked to better job performance (Shiba *et al*. 2015). Improving health behaviors have the potential to impact employee health, safety, and productivity as well as reduce employee and employer direct and indirect costs (Goldberg *et al*. 2015, Loeppke *et al*. 2008). Our

intervention has demonstrated numerous benefits, including enhanced health knowledge and improvement in lifestyle, suggesting that increasing health knowledge could be a critical factor in improving and sustaining health outcomes.

The strengths of our study sum up to some main assets. Firstly, most studies conducted so far are cross-sectional so that causality cannot be clearly established. Interventions in working samples are scarce because they are expensive and difficult to implement in an organizational context while there are few web-based interventions that target organizational or individual and organization interface factors (Nielsen & Abildgaarg 2013, Ryan *et al*. 2017). The major strength of this study is the randomized controlled trial design, which is the most reliable design for intervention studies. Another advantage is that it combines different relaxation techniques and is marked by a distinct transition in focus from the traditional face to face format to web-based delivery modalities. The benefit of the web-based intervention was the potential to access a larger target group and it had fewer constraints regarding time and location. However, we also kept the traditional face-to-face format, giving the employees the capability to choose physical presence during the sessions.

The findings of this study are subject to at least some limitations. Firstly, measuring the same constructs in the participants may lead to testing bias. Secondly, diffusion may occur since employees in the stress management group may exchange information with their colleagues about the program. Thirdly, although our intervention seems quite promising in improving future individual's job performance, we did not measure this construct, which is an important measurement for any organization, as well as the sickness absence. Finally, intervention bleeding, meaning the inclusion of a part of the one intervention's content in the other program by a researcher carrying multiple interventions (Robson 2002), could be a potential risk for the internal validity of the study results.

Human factor is the most critical resource for any organizations. The workforce needs to be regularly motivated through incentives and resources. A stress management program could function as a resource for the employees and can act as a buffer against the negative impact of job demands on employee health and job strain while it can promote personal growth, learning and development (Bakker & Demerouti 2007, Bakker *et al*. 2005, Geleto *et al*. 2015). A stress management programme could function as a resource for the employee providing the necessary 'tools' to confront everyday and occupational life since surveys have shown that higher levels of stress are related to an increased risk of reporting suboptimal job satisfaction and quality of life. (Alexopoulos *et al*. 2014). As other studies have shown, by providing stress coping strategies, stress could be reduced to manageable levels helping employees to function more efficiently and maintain mental health and inner harmony (Kourmousi & Alexopoulos 2016). The individual -focused strategies, like relaxation techniques, biofeedback, progressive muscle relaxation, guided imagery and 'Pythagorean self awareness', we have applied in this stress management program can be undertaken since they are easily taught.

In conclusion, both intervention techniques could benefit employees and should be tested in various labor settings. Future studies should extend these preliminary findings in order to investigate possible long-term effects. Thus, organizational focused strategies like adapting organization structure, selection and placement, training, altering job characteristics, job rotation and emphasizing health concerns can reduce employee health risks and promote wellness. The private sector has a responsibility to ensure and promote employees' health and well-being as part of their corporate social responsibility.

Acknowledgments

We gratefully thank all the employees for their participation.

Conflicts of Interest

The authors have no conflict of interest to declare.

Authors' Contributions

Evangelia Sioula designed the study, recruited employees, collected, analyzed the data and wrote the initial draft. Xanthi Tigani carried out data collection. Artemios Artemiadis performed the statistical analysis. George P. Chrousos supervised the project. Christina Darviri conceived of the original idea and supervised the project. Evangelos C. Alexopoulos supervised the project, data analysis and critically revised the manuscript. All authors read and reviewed the final manuscript.

References

Alexopoulos EC, Argyriou E, Bourna V & Bakoyannis G 2015 Reliability and Validity of the Job Content Questionnaire in Greek Health Care Workers. *Saf Health Work* **6** 233-239

Alexopoulos EC, Palatsidi V, Tigani X & Darviri C 2014 Exploring stress levels, job satisfaction, and quality of life in a sample of police officers in Greece. *Saf Health Work* **5** 210-5

Alexopoulos EC, Zisi M, Manola G & Darviri C 2014 Short-term effects of a randomized controlled worksite relaxation intervention in Greece. *Ann Agric Environ Med* **21** 382-7

Alosaimi FD, Almufleh A, Kazim S & Aladwani B 2015 Stress-coping strategies among medical residents in Saudi Arabia: A cross-sectional national study. *Pak J Med Sci* **31** 504-9

Andreou, E, Alexopoulos EC, Lionis C, Varvogli, L, Gnardellis C, Chrousos GP & Darviri C 2011 Perceived stress scale: Reliability and validity study in Greece. *Int J Environ Res Public Health* **8** 3287-3298

Bakker AB & Demerouti E 2007 The job demands-resources model: State of the art. *J Man Psychol* **22** 309-328Bakker AB, Demerouti E & Euwema MC 2005 Job resources buffer the impact of job demands on burnout and performance. *J Occup Health Psychol* **10** 170-180

Benedict RHB 1997 Brief Visuospatial Memory Test Revised professional manual. Odessa, FL: *Psychological Assessment Resources*. Bhui KS, Dinos S, Stansfeld SA & White PD 2012 A Synthesis of the Evidence for Managing Stress at Work: A Review of the Reviews Reporting on Anxiety, Depression, and Absenteeism. *J Environ Public Health* 2012 515874

Blix E, Perski A, Berglund H & Savic I 2013 Long-Term Occupational Stress Is Associated with Regional Reductions in Brain Tissue Volumes. *PLOS One* **8** e64065.

Cohen S, Kamarck T & Mermelstein R 1983 A Global Measure of Perceived Stress. *J Health Soc Behav,* **24** 385-396

Darviri C, Alexopoulos EC, Artemiadis AK, Tigani X, Kraniotou C, Darvyri P & Chrousos GP 2014 The Healthy Lifestyle and Personal Control Questionnaire (HLPCQ): a novel tool for assessing self-empowerment through a constellation of daily activities. *BMC Public Health* **14** 995

Darviri C, Zavitsanou C, Delikou A, Giotaki A, Artemiadis A, Anagnostouli M, Varvogli L, Vasdekis S & Chrousos GP 2016 Pythagorean Self-Awareness serves succesfully as a new cognitive behavioral based technique in multiple sclerosis physical and phychosocial well being and quality of life. *PSYCH* **7** 572-583

Darviri C, Zavitsanou C, Delikou A, Giotaki A, Artemiadis A, Terentiou A & Chrousos GP 2016 A Novel Non-Pharmaceutical Treatment for Patients with Mild Cognitive Impairment. *PSYCH* **7**

De Bloom J, Kinnunen U & Korpela K 2014 Exposure to nature versus relaxation during lunch breaks and recovery from work: development and design of an intervention study to improve workers' health, well-being, work performance and creativity. *BMC Public Health* **14** 488

Dusek JA, Otu HH, Wohlhueter AL, Bhasin M, Zerbini LF, Joseph MG, Benson H & Libermann TA 2008 Genomic Counter-Stress Changes Induced by the Relaxation Response. *Plos One* **2** e2576

Geleto A, Baraki N, Atomsa GE & Dessie Y 2015 Job satisfaction and associated factors among health care providers at public health institutions in Harari region, eastern Ethiopia: a cross-sectional study. *BMC Research Notes* **8** 394

Glynou E, Schwarzer R & Jerusalem M 1994 Greek Adaptation of the General Self-Efficacy Scale. Retrieved from http://userpage.fu-berlin.de/health/greek.htm

Goldberg L, Lockwood C, Garg B & Kuehl KS 2015 Healthy Team Healthy U: A Prospective Validation of an Evidence-Based Worksite Health Promotion and Wellness Platform. *Front Public Health* **43** 188

Griep RH, Nobre AA, Alves MG, da Fonseca Mde J, Cardoso Lde O, Giatti L, Melo EC, Toivanen S & Chor D 2015 Job strain and unhealthy lifestyle: results from the baseline cohort study, Brazilian Longitudinal Study of Adult Health (ELSA-Brasil). *BMC Public Health* **15** 309

Harzer C & Ruch W 2015 The relationships of character strengths with coping, work-related stress, and job satisfaction. *Front Psychol* **6** 165

Hofmann SG, Asnaani A, Vonk IJ, Sawyer AT & Fang A 2012 The efficacy of Cognitive Behavioral Therapy: A Review of Meta-analyses. *Cognit Ther Res* **36** 427-440

Huang SL, Li RH, Huang FY & Tang FC 2015 The Potential for Mindfulness-Based Intervention in Workplace Mental Health Promotion: Results of a Randomized Controlled Trial. *PLoS One* **10** e0138089

Joyce S, Modini M, Christensen H, Mykletun A, Bryant R, Mitchell PB & Harvey SB 2016 Workplace interventions for common mental disorders: a systematic meta-review. *Psychol Med* **46** 683-97

Karademas EC 2009 Effects of exposure to the suffering of unknown persons on health-related cognitions, and the role of mood. *Health (London)* **13** 491–504

Klatt M, Steinberg B & Duchemin *AM 2015 Mindfulness in Motion* (MIM): An Onsite Mindfulness Based Intervention (MBI) for Chronically High Stress Work Environments to Increase Resiliency and Work Engagement. *J Vis Exp* **1** e52359

Kotronoulas GC, Papadopoulou CN, Papapetrou A & Patiraki E 2011 Psychometric evaluation and feasibility of the Greek Pittsburgh sleep quality index (GR-PSQI) in patients with cancer receiving chemotherapy. *Support Care Center* **19** 1831-1840

Kourmousi N & Alexopoulos EC 2016 Stress Sources and Manifestations in a Nationwide Sample of Pre-Primary, Primary, and Secondary Educators in Greece. *Front Public Health* **21** 73

Langdon DW, Amato MP, Boringa J, Brochet B, Foley F, Fredrikson S, Hamalainen P, Hartung HP, Krupp L, Penner IK, Reder AT & Benedict RH 2012 Recommendations for a brief international cognitive assessment for multiple sclerosis (BICAMS). *Mult Scler* **18** 891-898.3

Lawrence C, Roy A, Harikrishnan V, Yu S & Dabbous O 2013 Association between severity of depression and self-perceived cognitive difficulties among full-time employees. *Prim Care Companion CNS Disord* **15**

Loeppke R, Nicholson S, Taitel M Sweeney M, Haufle V & Kessler RC 2008 The impact of an integrated population health enhancement and disease management program on employee health risk, health conditions, and productivity. *Popul Health Manag* **11** 287-96

Lovibond SH & Lovibond PF 1995 Manual for the Depression Anxiety Stress Scales (2nd ed.). *Sydney: Psychology Foundation of Australia*.

Lyrakos GN, Arvaniti C, Smyrnioti M & Kostopanagiotou G 2011 Translation and validation study of the depression anxiety stress scale in the Greek General population and in a psychiatric patient's sample. *European Psychiatry* **26** 1731

Marschall D, Sanftner J & Tangney JP 1994 The State Shame and Guilt Scale. Fairfax, VA: George Mason University.

Murphy LR 1996 Stress management in work settings: a critical review of the health effects. *Am J Health Promot* **11** 112-35

Nielsen K & Abildgaard JS 2013 Organizational interventions: a research-based framework for the evaluation of both process and effects. *Work Stress* **27** 278-297

Ninaus K, Diehl S, Terlutter R, Chan K & Huang A 2015 Benefits and stressors Perceived effects of ICT use on employee health and work stress: An exploratory study from Austria and Hong Kong. *Int J Qual Stud Health Well-being* **12** 28838

Padma V, Anand NN, Gurukul SM, Javid SM, Prasad A & Arun S 2015 Health problems and stress in Information Technology and Business Process Outsourcing employees. *J Pharm Bioallied Sci* 7 9-13

Pedersen P, Sogaard HJ, Labriola M, Nohr EA & Jensen C 2015. Effectiveness of psycho education in reducing sickness absence and improving mental health in individuals at risk of having a mental disorder: a randomized controlled trial. *BMC Public Health* **15** 763

Rabe M, Giacomuzzi S & Nubling M 2012 Psychosocial workload and stress in the workers' representative. *BMC Public Health* **12** 909

Rao VJ & Chandraiah 2012 Occupational stress, mental health and coping among information technology preofessionals. *Indian J Occup Environ Med* **16** 22-26

Ravalier JM, Wegrzynek P & Lawton S 2016 Systematic review: complementary therapies and employee well-being. *Occup Med* **66** 428-36

Richardson KM & Rothstein HR 2008 Effects of occupational stress management intervention programs: a meta-analysis. *J Occup Health Psychol* **13** 69-93

Robson C 2002 Real world research: A resource for social scientists and practitioner-researchers. 2nd edition *Malden MA: Blackwell Publishing*

Ryan C, Bergin M, Chalder T & Wells JSG 2017 Web-based interventions for the management of stress in the workplace: Focus, form and efficacy. *J Occup Health* **59** 215-236

Sheridan LK, Fitzgerald HE, Adams KM, Nigg JT, Martel MM, Puttler LI, Wong MM & Zucker RA 2006 Normative Symbol Digit Modalities Test performance in a community-based sample. *Arch Clin Neuropsychol* **21** 23-8

Shiba K, Nishimoto M, Sugimoto M & Ishikawa Y 2015 The Association between Meditation Practice and Job Performance: A Cross-Sectional Study. *Plos One* **10** e0128287

Stegen S, Stepanov I, Cookfair D, Schwartz E, Hojnacki D, Weinstock-Guttman B & Benedict RH 2010 Validity of the California Verbal Learning Test–II in multiple sclerosis. *The Clin Neuropsychol* **24** 189-202

Wallston KA, Wallston BS & DeVellis R 1978 Development of the multidimensional health locus of control (MHLC) scales. *Health Educ Monogr* **6** 160-170

Wong CS & Law KS 2002 The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. *The Leadership Quarterly* 13 243–274