

EFFECT OF YOGA ON DIFFERENT ASPECTS OF MENTAL HEALTH

SHIRLEY TELLES*, NILKAMAL SINGH, ARTI YADAV
AND ACHARYA BALKRISHNA

*Patanjali Research Foundation
Haridwar, India*

(Received on March 19, 2011)

Abstract : State anxiety, somatization of stress, quality of life, self-rated quality of sleep, and discomfort due to over-breathing which occurs when stressed were studied. Out of a total of 140 participants, seventy participants self-selected to be in a yoga group for stress relief (group mean age \pm SD, 33.0 \pm 6.5 years; 37 males). Seventy age and gender matched participants were in a control group. State anxiety, somatization of stress, quality of life, discomfort and self-rated quality of sleep were assessed using the State-Trait Anxiety Inventory, Symptom Checklist-90-R, SF-12, Nijmegen Discomfort Evaluation Scale and a Sleep Rating Questionnaire respectively. Assessments were made at the beginning and end of the week. Repeated measures ANOVAs with Bonferroni adjusted *post-hoc* analyses showed a significant decrease in state anxiety (P<0.001), somatization of stress (P<0.01), improved health-related quality of life (P<0.01), self-rated quality of sleep (P<0.01), and decrease in discomfort due to over-breathing (P<0.001). No changes (except decreased discomfort due to over-breathing; P<0.01) occurred in the control group. This study suggests that a brief yoga program may be beneficial in decreasing anxiety, somatization of stress and discomfort, improving health-related quality of life and self-rated sleep quality.

Key words : yogastate anxiety
quality of life

somatization of stress
self-rated sleep

INTRODUCTION

The practice of yoga increased wellbeing, reduced stress, and helped in treatment (1). In a single group study on seventy-seven participants, subjective wellbeing significantly improved after ten days of yoga and lifestyle changes along with a reduction in state and trait anxiety, in different participants (2, 3).

Yoga also reduced somatization of stress in professional computer users following a two month program (4).

Practicing yoga alleviated depression and anxiety in women who were symptomatic and randomized as control and yoga groups (5). The yoga group showed a significant decrease in state and trait anxiety. More

*Corresponding Author : Shirley Telles Ph.D., Patanjali Research Foundation, Bahadradab, Near Haridwar, Uttarakhand – 249 402, India, Tel. No.: 91-1334-24008, Fax: 91-1334-244805; E-mail: shirleytelles@gmail.com

recently, both yoga practice as well as listening to a lecture on yoga reduced state anxiety, with a greater reduction following yoga practice (6).

The effect of yoga has been studied in persons prone to developing anxiety. Three examples will be cited here. Musicians, prone to performance anxiety were given a yoga program (7). The yoga participants compared to a non-yoga group showed improvement in stress, performance anxiety, and performance-related musculo-skeletal conditions. Self-reported state and trait anxiety also reduced in patients with early breast cancer undergoing conventional treatment compared to a non-yoga group, at different stages of the treatment schedule (8). The third example was survivors of the 2004 South Asian tsunami, who reported reduced anxiety following a week of yoga (9). Their sleep disturbances also reduced.

Also, chronic insomniacs showed certain benefits with yoga (10). Following yoga there were statistically significant improvements in sleep efficiency, total sleep time, total wake time, sleep onset latency and wake time after sleep onset, compared with values before practicing yoga.

Yoga practice reduced sleep disturbances in an older population (11). Following six months of yoga there was a significant decrease in the time taken to fall asleep, an increase in the total number of hours slept, and in the subjective feeling of being rested in the morning.

With the changes given above it is not surprising that in healthy seniors yoga improved quality of life measures associated

with a sense of wellbeing, improved energy and reduced fatigue, compared to controls (12).

Most yoga practices emphasize the importance of breathing and breath regulation (13). However, the two are distinct. Over-breathing can lead to somatic symptoms, typically hyperventilation. It was important to determine whether the present participants were breathing correctly or were over-breathing, as yoga breathing techniques were a major part of the program. Also, people who are anxious are more likely to hyperventilate (14).

Hence, the present study aimed to assess the effects of a yoga program, on (i) state anxiety, (ii) somatization of stress, (iii) health related quality of life, (iv) discomfort due to over-breathing, and (v) self-rated quality of sleep in seventy persons who had joined for a one week yoga program for stress relief. An age and gender matched non-yoga control group was assessed for comparison. To our knowledge this is the first attempt to simultaneously assess all these variables following yoga practice.

MATERIAL AND METHODS

Participants

There were one hundred and forty volunteers aged between 21-46 years. Seventy participants had self-selected to join for a one week yoga residential program (37 males, age group mean \pm SD; 33.0 \pm 6.5 years). The control group participants were non-yoga practitioners who were selected to match the yoga group for age (\pm 6 months). The participants were told that the study was

intended to assess how they felt either after one week of the yoga program (yoga group) or after their routine activities (control group) compared to before. The signed informed consent of all participants was taken. The study had the approval of the institution's ethics committee.

Study design

Assessments were made on the first and last day of either one week of the yoga program or after one week of no intervention.

Assessments

All questionnaires were blind scored by a single evaluator.

State Trait Anxiety Inventory (STAI)

The State-Trait Anxiety Inventory was used to assess state anxiety at the moment of testing (15). Trait anxiety was not measured. In responding to the State-Anxiety sub-scale, the participants chose the number that best described the intensity of their feelings at that moment, i.e., not at all = 1, somewhat = 2, moderately = 3, and very much so = 4.

Symptom Checklist-90-R (SCL-90-R)

Participants were given the Symptom Checklist-90-R for evaluation of symptoms of somatization of stress (16). The questionnaire assessed twelve symptoms associated with physical pain and discomfort on a five point scale, i.e., not at all = 0, a little bit = 1, moderately = 2, quite a bit = 3, and extremely = 4.

SF-12 (short form)

Participants were administered SF-12 as a multidimensional generic measure of the health-related quality of life (17). The questionnaire consists of 12 items selected from the SF-36 which were (i) dichotomous [i.e., with two options (yes or no) in questions 4, 5, 6 and 7], and (ii) had multiple choices for questions 1, 2, 3, 8, 9, 10, 11, and 12. Scoring was carried out according to the standard method (18).

Nijmegen Discomfort Evaluation Scale

Participants were given the standardized Nijmegen Questionnaire to detect symptoms of over-breathing or hyperventilation in the preceding week (19). The questionnaire assessed symptoms associated with over-breathing on a five point scale, i.e., never = 0, seldom = 1, sometimes = 2, often = 3, and very often = 4.

Sleep Rating Questionnaire (SRQ)

The Sleep Rating Questionnaire was used to assess changes in the quality of sleep self-rated by the participants. The reliability and validity of this questionnaire were established and described elsewhere (11). The questionnaire consisted of seven questions which were either dichotomous [i.e., with two options (yes or no) as in questions 5 and 6, or open-ended questions (i.e., questions 1, 2, 3, 4 and 7)]. The seven questions were: 1. Approximately how long (in mins) does it take you to fall asleep? 2. How many hours do you sleep each night? 3. How many times (if any) do you wake up during the night? 4. What are the usual reasons for waking up if

you do so? 5. Do you feel rested in the morning? 6. Do you sleep in the day time? 7. If your answer to question 6 was 'Yes', for how long do your daytime naps last? (in mins)

Intervention

The yoga program consisted of two sessions each day. The first session was between 05:00 hours and 07:30 hours and the second session was between 17:00 hours and 19:30 hours. In each session participants practiced voluntarily regulated yoga breathing (*kriyas* or cleansing techniques and *pranayamas*) for sixty percent of the time, loosening exercises (*sukshma vyayamas*) for twenty percent of the time, and yoga postures (*asanas*) for the remaining twenty percent of the time. In this yoga program the emphasis was on yoga breathing techniques. The breathing techniques included high frequency yoga breathing (*kapalabhati*), breathing through alternate nostrils (*anulom-vilom pranayama*), exhalation with specific sounds (*brahmari* and *udgeeth pranayamas*), and breathing with a period of breath holding or with a voluntarily partially constricted glottis (*bahya* and *ujjayi pranayamas*, respectively). This yoga program has come to be called *Patanjali Yoga*, as it is based on the traditional teachings of *Patanjali* (circa 900 B.C.) and has been taught by Swami Ramdev (20).

The control group participants were performing their routine activities.

Data extraction

Standard methods were used to score state anxiety (15), somatization of stress (16),

and the symptoms of discomfort due to over-breathing or hyperventilation (19). Each raw score of the SF-12 was converted into physical and mental component summary scores (PCS and MCS) according to the standard procedure (18). The self-rating sleep evaluation questionnaire had four questions which had quantifiable responses in terms of the number of minutes taken to fall asleep (question 1), total hours spent in sleep (question 2) and length of a day time nap (if any). The other questions also had responses which could be quantified (e.g., the number of awakenings in the night, the feeling of being rested in the morning (as '0' or '1'), and the number of minutes slept each afternoon.

Data were scored and the group mean \pm SD, were calculated before and after yoga and control sessions, for the seventy age and gender matched participants in each group.

Data analysis

Statistical analysis was carried out with PASW (SPSS version 18). Data of the age matched experimental and control groups were analyzed using the repeated-measures analyses of variance (ANOVAs). There was one between-subjects factor, i.e., Groups (Yoga and Control) and one within-subjects factor, i.e., States (at the beginning and end of one week). Since tests were repeated for the two groups repeated measures ANOVAs were performed. *Post-hoc* analyses with Bonferroni adjustment were used to detect if there was a significant difference between mean values.

RESULTS

For each of the five questionnaires

administered the change after yoga compared to before as well as compared to the control session has been mentioned.

State anxiety

The repeated-measures ANOVAs showed a significant difference between States (i.e., before and after) for scores of state anxiety [$F_{1,138} = 19.36, P < 0.001$] at the end of the yoga program. There was a significant interaction between Groups and States for state anxiety scores [$F_{1,138} = 4.00, P < 0.05$] suggesting the two factors were not independent of each other.

Post-hoc tests for multiple comparisons were performed with Bonferroni adjustment. After the yoga program there was a significant decrease in the scores of state anxiety ($P < 0.001$). In contrast there was no

significant change in the control group. Apart from this there was no significant difference between pre states of both groups. However there was a statistically significant difference between post states of both groups ($P < 0.01$). The group mean \pm SD, are given in Table I.

Symptom checklist-90-R (SCL-90-R)

The repeated-measures ANOVAs showed a significant difference between States for the symptoms of somatization of stress (SCL-90-R) [$F_{1,138} = 7.89, P < 0.01$] at the end of the yoga program. There was a significant interaction between Groups and States for SCL-90-R for scores of symptoms of somatization of stress [$F_{1,138} = 14.89, P < 0.001$] suggesting the two factors were not independent.

Post-hoc tests for multiple comparisons

TABLE I: Scores obtained in various questionnaires after one week of yoga or no intervention (control). Values are group mean \pm SD.

No.	Variables	Session	States	Group mean \pm SD
1.	STAI	Yoga	Before	39.83 \pm 11.58
			After	34.69 \pm 10.44***
		Control	Before	41.37 \pm 11.05
			After	39.44 \pm 11.44
2.	SCL-90-R	Yoga	Before	10.93 \pm 6.05
			After	7.03 \pm 5.90***
		Control	Before	5.69 \pm 5.66
			After	6.30 \pm 7.34
3.	SF-12 (Physical component summary score)	Yoga	Before	40.13 \pm 7.21
			After	44.51 \pm 8.50***
		Control	Before	42.04 \pm 5.46
			After	42.44 \pm 7.07***
4.	SF-12 (Mental component summary score)	Yoga	Before	44.59 \pm 5.82
			After	51.93 \pm 5.61***
		Control	Before	47.94 \pm 7.07
			After	49.00 \pm 6.99
5.	Discomfort	Yoga	Before	13.79 \pm 7.19
			After	9.20 \pm 7.14***
		Control	Before	12.31 \pm 9.52
			After	9.43 \pm 8.52***

*=($P < 0.05$), **=($P < 0.01$), ***=($P < 0.001$), After values compared to Before.

were performed with Bonferroni adjustment. There was a significant decrease in the scores of symptoms of somatization of stress (SCL-90-R) after yoga ($P < 0.001$) but not in the control group. Also there was a significant difference between the mean Before values for yoga and control groups ($P < 0.01$) but there was no significant difference between the After mean values of both groups. The group mean \pm SD, are given in Table I.

SF-12 (Short form)

The repeated-measures ANOVAs showed a significant difference between States for both physical and mental component summary scores (PCS and MCS) of SF-12 [$F_{1,138} = 8.76$, $P < 0.01$; $F_{1,138} = 31.09$, $P < 0.001$ respectively] at the end of the yoga program. There was a significant interaction between physical and mental component summary scores (PCS and MCS) of SF-12 between Groups and States [$F_{1,138} = 6.07$, $P < 0.05$; $F_{1,138} = 17.41$, $P < 0.001$] suggesting the two factors were interdependent.

Post-hoc tests for multiple comparisons were performed with Bonferroni adjustment. After yoga there was a significant increase in both physical and mental component summary scores for SF-12 ($P < 0.001$). In contrast there was no change in the control group. Apart from this, there was a significant difference between before ($P < 0.01$) and after ($P < 0.01$) values of both groups for the mental component summary scores of SF-12, while there were no significant differences between the before and after values of both groups for the physical component summary scores of SF-12. The group mean \pm SD, are given in Table I.

Nijmegen discomfort evaluation questionnaires

Nijmegen Discomfort Evaluation Questionnaire detects symptoms of discomfort due to over-breathing or hyperventilation (21). The scores for the group as a whole at baseline were not suggestive of discomfort (i.e., scores < 23). The repeated-measures ANOVAs showed a significant difference between states for scores of discomfort [$F_{1,138} = 13.71$, $P < 0.001$] after the yoga program.

Post-hoc tests for multiple comparisons were performed with Bonferroni adjustment. After both sessions there was a significant decrease in the scores of discomfort ($P < 0.001$) i.e., control as well as yoga group, but the magnitude of change was greater in the yoga group compared to the control group. Apart from this there were no significant differences between before and after values of both groups. The group mean \pm SD, are given in Table I.

Sleep rating questionnaire

The repeated-measures analyses of variance (ANOVAs) showed a significant difference between States for (i) time taken to fall asleep, (ii) total hours spent in sleep, and (iii) number of awakenings during the night [$F_{1,138} = 21.95$, $P < 0.001$; $F_{1,138} = 8.52$, $P < 0.01$; $F_{1,138} = 11.705$, $P < 0.01$] at the end of the yoga program. There were a significant interaction between Groups and States for (i) time taken to fall asleep, and (ii) total hours spent in sleep [$F_{1,138} = 5.68$, $P < 0.05$; $F_{1,138} = 8.91$, $P < 0.01$ respectively] suggesting the two factors were interdependent.

Post-hoc tests for multiple comparisons

were performed with Bonferroni adjustment. After the yoga program there was a significant decrease in (i) time taken to fall asleep, (ii) total hours spent in sleep, and (iii) number of awakenings during the night ($P < 0.001$ in all cases). In addition to this (iv) there was also a significant increase in the feeling of being rested in the morning ($P < 0.001$). In contrast there were no significant changes in these variables in the control group. Apart from this there was a statistically significant difference between after values of both groups in total hours spent in sleep ($P < 0.05$) and between before values of both groups in number of awakenings during the night. However there were no significant differences between other variables when before and after values of

both groups were compared. The group mean values \pm SD, are given in Table II. A summary of the results and their interpretation are given in Table III.

DISCUSSION

The present study showed a significant decrease in state anxiety, improvement in self-rated quality of sleep, decrease in somatization of stress and in symptoms of discomfort due to over-breathing following one week of yoga. Changes were comparable for participants of both sexes.

The way in which yoga may reduce state anxiety has been speculated upon. It is generally recognized that excessive anxiety

TABLE II: Scores obtained in sleep rating questionnaire after one week of yoga or no intervention (control). Values are group $M \pm SD$.

No.	Variables	Session	States	Group mean \pm SD
1.	Sleep Rating Questionnaire			
(i)	Time taken to fall asleep (mins)	Yoga	Before After	26.41 \pm 20.65 17.94 \pm 14.07***
		Control	Before After	22.69 \pm 14.82 19.93 \pm 13.25
(ii)	Total hours spent in sleep (hours)	Yoga	Before After	6.64 \pm 1.68 6.01 \pm 1.33**
		Control	Before After	6.56 \pm 1.10 6.56 \pm 1.13
(iii)	Number of awakenings in the night	Yoga	Before After	1.67 \pm 1.13@ 1.36 \pm 0.95**
		Control	Before After	1.29 \pm 1.11 1.16 \pm 1.13
(iv)	Feeling of being rested in the morning	Yoga	Before After	0.74 \pm 0.44 0.89 \pm 0.32*
		Control	Before After	0.87 \pm 0.35 0.81 \pm 0.39
(v)	Number of minutes slept in the afternoon	Yoga	Before After	0.71 \pm 0.46 0.69 \pm 0.47
		Control	Before After	0.13 \pm 0.37 0.21 \pm 0.41

*= $P < 0.05$, **= $P < 0.01$, ***= $P < 0.001$ comparing After with Before; @= $P < 0.05$ comparing Before Yoga with Before Control.

TABLE III: Percentage change-in different variables and the interpretation.

No.	Questionnaire	Yoga	Control
1.	STAI – state anxiety sub scale	Decrease in state anxiety (12.9 percent)	No change in state anxiety
2.	SCL-90-R	Decrease in somatization of stress (35.6 percent)	No change in somatization of stress
3.	SF-12 (PCS)	Increase in the physical component of health-related quality of life (10.9 percent)	Increase in the physical component of health-related quality of life (0.95 percent)
4.	SF-12 (MCS)	Increase in the mental component of health-related quality of life (16.4 percent)	No change in the mental component of health-related quality of life
5.	Nimgegen Questionnaire	Decrease in hyperventilation (32.5 percent)	Decrease in hyperventilation (23.3 percent)
6.	SRQ		
(i)	Time taken to fall asleep (min)	Decrease in time taken to fall asleep (32 percent)	No change time taken to fall asleep
(ii)	Total hours spent in sleep (hours)	Decrease in total hours spent in sleep (9.4 percent)	No change in total hours spent in sleep
(iii)	Number of awakenings in the night	Decreased awakenings in the night (18.5 percent)	No change in awakenings in the night
(iv)	Feeling of being rested in the morning	Increase in feeling of being rested in the morning (20 percent)	No change in the feeling of being rested in the morning
(v)	Number of minutes slept in the afternoon	No change in time slept in the afternoon	No change in time slept in the afternoon

is maladaptive (3). Yoga practice may modify anxiety by the effect on breathing through muscle relaxation, and by hence modifying the mental state to induce feelings of wellbeing (22). Slow and deep breathing increase the parasympathetic tone and are associated with a calm mental state (23). Rapid yoga breathing techniques are followed by periods of subjectively rated calmness associated with periods of slow-electroencephalogram (EEG) frequencies (24).

Apart from yoga voluntarily regulated breathing (or *pranayamas*) another yoga practice associated with reduced anxiety is the practice of yoga postures (or *asanas*). Many of the benefits of yoga postures are ascribed to muscle stretching associated with yoga postures, which is believed to help in reducing pain (25). Apart from these effects

which are easy to associate with yoga practice, more complex effects of yoga *asanas* have also been shown. Two studies demonstrated that γ -aminobutyric acid (GABA)-ergic activity increased after yoga practice. In one study experienced yoga practitioners had 27 percent increase in GABA levels using magnetic resonance spectroscopy (26). The increase in GABA levels was seen in experienced yoga practitioners after a 60 - minute session of practicing yoga postures compared to no change in GABA levels in controls after they were asked to read for the same amount of time. This study resulted in the question, that is whether the increase in GABA levels was specific to yoga or was due to the overall increase in physical activity. The same authors provided the answers for this in a subsequent study which compared GABA

levels in a yoga and a walking group (27). The twelve week yoga intervention was associated with greater improvements in mood and lower anxiety, compared to a metabolically matched walking exercise group. This study was also the first to demonstrate that increased thalamic GABA levels are associated with improved mood and decreased anxiety. The implications of the study were that GABA may be mediating some, if not all of the beneficial effects of yoga on mood and anxiety.

Anxiety and sleep disturbance often occur simultaneously. The improvement in self-rated quality of sleep after a week of yoga may be related to multiple factors. Various factors influence sleep, and these have different biological and chemical origins (28). For example high intensity exercise has been shown to result in a significant increase in the sleep promoting substance, adenosine. While yoga practice (particularly the program described here) cannot be considered a high intensity exercise, the participants' physical activity would definitely have increased during the week long yoga camp, compared to their usual routine.

With a reduction in anxiety, it is not surprising that subjectively rated somatization of stress significantly decreased, since anxiety and stress-related somatic symptoms are closely related (29). The correlation between specific somatic symptoms and chronic hyperventilation is poorly understood. However the fact that the

scores in the Nijmegen questionnaire which assesses discomfort due to over-breathing were not high at baseline suggests that these participants were not over-breathing and were practicing the techniques correctly.

An improvement in the health related quality of life (based on the SF-12) is not unexpected considering the other changes mentioned above. The present results do suggest that persons seeking stress relief can get mental health benefits with a week of yoga practice. However the study has two main limitations, these are (i) this was not a randomized trial since the yoga group was self selected, while the control group had no intervention, and (ii) for three of the measures (the SCL-90-R, SF-12 mental component summary scores and number of awakenings in the night) the before values of the two groups were significantly different. However despite these limitations the results suggest the use of yoga for patients who are stressed and have insomnia, somatic symptoms and a decrease in their quality of life due to stress.

ACKNOWLEDGEMENTS

The help given by Vaishali Gaur, Ph.D. and Kanchan Maharana, M.A. in carrying out the assessments is gratefully acknowledged.

Conflict of interest

The authors state that there is no conflict of interest.

REFERENCES

1. Balkrishna A. *Yog in Synergy with Medical Science*. Haridwar, India: Divya Prakashan; 2007.
2. Sharma R, Gupta N, Bijlani RL. Effect of yoga based lifestyle intervention on subjective well-being. *Indian J Physiol Pharmacol* 2008; 52: 123-131.
3. Gupta N, Khera S, Vempati RP, Sharma R,

- Bijlani RL. Effect of yoga based lifestyle intervention on state and trait anxiety. *Indian J Physiol Pharmacol* 2006; 50: 41–47.
4. Telles S, Naveen KV. Effect of yoga on somatic indicators of distress in professional computer users. *Med Sci Monit* 2006; 12: EE 21–22.
 5. Javnbakht M, Hejazi KR, Ghasemi M. Effects of yoga on depression and anxiety of women. *Complement Ther Clin Pract* 2009; 15: 102–104.
 6. Telles S, Gaur V, Balkrishna A. Effect of yoga practice session and a yoga theory session on state anxiety. *Percept Mot Skills* 2009; 109: 924–930.
 7. Khalsa SB, Cope S. Effects of a yoga lifestyle intervention on performance-related characteristics of musicians: a preliminary study. *Med Sci Monit* 2006; 12: CR325–331.
 8. Rao MR, Raghuram N, Nagendra HR, et al. Anxiolytic effects of a yoga program in early breast cancer patients undergoing conventional treatment: a randomized controlled trial. *Complement Ther Med* 2009; 17: 1–8.
 9. Telles S, Naveen KV, Dash M. Yoga reduces symptoms of distress in tsunami survivors in the andaman islands. *Evid Based Complement Alternat Med* 2007; 4: 503–509.
 10. Khalsa SB. Treatment of chronic insomnia with yoga: a preliminary study with sleep-wake diaries. *Appl Psychophysiol Biofeedback* 2004; 29: 269–278.
 11. Manjunath NK, Telles S. Influence of Yoga and Ayurveda on self-rated sleep in a geriatric population. *Indian J Med Res* 2005; 121: 683–690.
 12. Oken BS, Zajdel D, Kishiyama S et al. Randomized, controlled, six-month trial of yoga in healthy seniors: effects on cognition and quality of life. *Altern Ther Health Med* 2006; 12: 40–47.
 13. Saraswati N. *Prana, Pranayama, Prana Vidya*. Bihar, India: Yoga publication trust; 2002.
 14. Garcia G. Hyperventilation syndrome. *Rev Prat* 2011; 61: 456–459.
 15. Spielberger CD, Gorsuch RL, Luchene RC. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press; 1970.
 16. Derogatis LR. Symptom check list-90-R: Administration, scoring and procedures-Manual II. Baltimore: Clinical Psychometric Research; 1983.
 17. Brazier JE, Roberts J. The estimation of a preference-based measure of health from the SF-12. *Med Care* 2004; 42: 851–859.
 18. Ware JE, Keller SD, Kosinski M. SF-12: How to score the SF-12 Physical and Mental Health Summary Scales (2nd ed.). Boston: The Health Institute, New England Medical Center; 1995.
 19. Van Doorn P, Folgering H, Colla P. Control of the end-tidal PCO₂ in the hyperventilation syndrome: effects of biofeedback and breathing instructions compared. *Bull Eur Physiopathol Respir* 1982; 18: 829–836.
 20. Anand AC. Swami Ramdev and scientific medicine: losing is fine, but the lesson should not be lost! *Natl Med J India* 2007; 20: 256–259.
 21. Van Dixhoorn J, Duivenvoorden HJ. Efficacy of Nijmegen Questionnaire in recognition of the hyperventilation syndrome. *J Psychosom Res* 1985; 29: 199–206.
 22. Kozasa EH, Santos RF, Rueda AD, Benedito-Silva AA, De Ornellas FL, Leite JR. Evaluation of Siddha Samadhi Yoga for anxiety and depression symptoms: a preliminary study. *Psychol Rep* 2008; 103: 271–274.
 23. Kaushik RM, Kaushik R, Mahajan SK, Rajesh V. Effects of mental relaxation and slow breathing in essential hypertension. *Complement Ther Med* 2006; 14: 120–126.
 24. Novak P, Lepicovska V, Dostalek C. Periodic amplitude modulation of EEG. *Neurosci Lett* 1992; 136: 213–215.
 25. Garfmkel M, Schumacher HR. Yoga. *Rheum Dis Clin North Am* 2000; 26: 125–132.
 26. Streeter CC, Jensen JE, Perlmutter RM et al. Yoga Asana sessions increase brain GABA levels: a pilot study. *J Altern Complement Med* 2007; 13: 419–426.
 27. Streeter CC, Whitfield TH, Owen L et al. Effects of yoga versus walking on mood, anxiety, and brain GABA levels: a randomized controlled MRS study. *J Altern Complement Med* 2010; 16: 1145–1152.
 28. Patra S, Telles S. Positive impact of cyclic meditation on subsequent sleep. *Med Sci Monit* 2009; 15: CR375–CR381.
 29. Wientjes CJ, Grossman P. Over reactivity of the psyche or the soma? Interindividual associations between psychosomatic symptoms, anxiety, heart rate, and end-tidal partial carbon dioxide pressure. *Psychosom Med* 1994; 56: 533–540.