Advance Access Publication 30 June 2007

*eCAM 2007;4(4)503–509*
doi:10.1093/ecam/nem069

**Original Article**

# Yoga Reduces Symptoms of Distress in Tsunami Survivors in the Andaman Islands

**Shirley Telles, K. V. Naveen and Manoj Dash**

Swami Vivekananda Yoga Research Foundation (A Yoga University), Bangalore, India

A month after the December 2004 tsunami the effect of a 1 week yoga program was evaluated on self rated fear, anxiety, sadness and disturbed sleep in 47 survivors in the Andaman Islands. Polygraph recordings of the heart rate, breath rate and skin resistance were also made. Among the 47 people, 31 were settlers from the mainland (i.e. India, ML group) and 16 were endogenous people (EP group). There was a significant decrease in self rated fear, anxiety, sadness and disturbed sleep in both groups, and in the heart and breath rate in the ML group, and in the breath rate alone in the EP group, following yoga ($P < 0.05$, *t*-test). This suggests that yoga practice may be useful in the management of stress following a natural disaster in people with widely differing social, cultural and spiritual beliefs.

**Keywords:** Indian Ocean tsunami – stress management – yoga

## Introduction

The Indian Ocean tsunami which occurred in December 2004 affected various parts of South-East Asia including the Andaman Islands. These islands consist of an archipelago in the Bay of Bengal, inhabited by hunter-gatherers who are believed to have originated from the Paleolithic age and Neolithic colonies of South-East Asia (1). The present population includes the endogenous people (EP) as well as settlers from the mainland (ML), i.e. India.

A month after the tsunami there was an initiative to introduce stress management techniques for the people who were temporarily relocated in camps in the capital (Port Blair), as their homes were destroyed. At that stage their immediate needs were provided. However, most of them were anxious and distressed, this being related to (i) the possible recurrence of the tsunami especially in the presence of 'after-shocks', (ii) being displaced and (iii) reconstructing their lives. Most of them also had to come to terms with losing their relatives, friends and property.

As a part of this initiative a survey was conducted on 646 people of whom 328 were endogenous people and 318 were mainland settlers (2). The two populations differed in their: (i) social organization, as the EP group form close communities under a 'tribal leader', whereas the ML group has the family as the main unit and (ii) religion, as most of the EP group follow Christianity, whereas most of the ML group are Hindus. The ML group had higher levels for four indicators of distress (i.e. anxiety, fear, sadness and disturbed sleep) which are commonly reported by disaster survivors (3). The groups also differed in their coping strategies with the EP group choosing interpersonal contact while the ML group chose denial strategies especially alcohol.

Yoga is an ancient Indian science which includes the practice of loosening exercises (*sithilikarana vyayama*), specific postures (*asanas*), cleansing practices (*kriyas*), voluntarily regulated breathing (*pranayamas*), yoga-based guided relaxation and meditation (*dhyana*) (4). Yoga training has been reported to decrease heart rate and breath rate, the signs of reduced psycho-physiological arousal in normal volunteers (5). Significant reductions were shown for depression, anger, anxiety, neurotic

For reprints and all correspondence: Shirley Telles PhD, Swami Vivekananda Yoga Research Foundation (A Yoga University), # 19, Eknath Bhavan, Gavipuram Circle, K.G. Nagar, Bangalore 560 019, India. Tel: +91-80-26612669; Fax: +91-80-26608645;
E-mail: shirleytelles@gmail.com

symptoms and low frequency heart rate variability in 17 patients with depression following training in *Iyengar yoga* (6).

The present study was designed to compare responses of the EP and ML groups to a 1 week yoga program, based on psycho-physiological variables, as well as their self rated indicators of distress.

## Methods

### Participants

There were 47 persons, of whom 16 were (EP) and 31 were second-generation immigrants from the ML. The groups were comparable with respect to education, socio-economic status and age range (28–50 years), but differed in their (i) social organization and (ii) religion. Both groups had lost their relatives and friends or their homes as a result of the tsunami. All of them were in normal health based on a routine clinical examination and were able to perform the yoga practices. All participants gave their consent to take part in the study. The project was approved by the institutional ethics committee.

### Design

All 47 participants were assessed on day 1 and on day 8 after receiving a 1 week program of 'Vivekananda yoga', detailed under 'Interventions' subsequently.

### Assessments

#### *Self rated Symptoms of Distress*

The participants rated the intensity of their feelings with respect to four symptoms, using a 10 cm visual analog scale (VAS). The four symptoms were fear, anxiety, disturbed sleep and sadness. These four symptoms were selected as they are commonly reported by disaster survivors (3).

The electrocardiogram (EKG), breath rate and skin resistance were recorded in all participants. These recordings were made simultaneously using a digital four channel polygraph (Medicaid, Chandigarh, India), with the participants seated in a quiet room which was set aside for medical treatment of camp participants. After coming to the recording room the participants were asked to be seated for 5 min followed by 10 min of recording.

### Assessment Procedure

#### *Visual Analog Scales*

Emotional impact in terms of fear, anxiety, disturbed sleep and sadness were calculated by measuring the distance in millimeters from the left of the analog scale (where the left end of the scale corresponded to '0' and the right end to '10'). All the analog scales were scored in one direction to make it easier to explain the method to the participants.

#### *Autonomic and Respiratory Measurements*

Polygraph recordings were taken of the (i) ECG using standard limb lead I, to obtain the heart rate by counting the number of QRS complexes in a minute, (ii) respiration using a mechanical stethograph placed below the costal margin, to get the breath rate and (iii) the skin resistance using Ag/AgCl electrodes placed in contact with the volar surfaces of the middle and ring fingers of the right hand, with a current of 15 μA passed between the electrodes.

### Intervention

#### *Philosophy of Vivekananda Yoga*

Yoga is an ancient Indian science and way of life which brings about relaxation and also induces a balanced mental state. The participants were taught 'Vivekananda Yoga' which is an integrated yoga program combining practices intended to act at physical, emotional, intellectual and even at spiritual levels. This yoga program is derived from principles in ancient texts (*Patanjali's Yoga Sutras* and *Taittreya Upanisad*) which emphasize that yoga should promote health at all levels (4,5). Another ancient Indian text (the *Mandukya Upanisad)* considers the 'body' as three parts namely. the physical part (*sthula sharira*), a subtle or inner part (*sukshma sharira*) and the causal body (*kaarana sarira*) (7). These three parts are represented as five levels of existence (*pancha koshas*) (5). These are the physical level (*annamaya kosha*), the level of subtle life energy (*pranayama kosha*), the level of emotional thinking (*manomaya kosha*), the level of rational thinking and judgment (*vijnanamaya kosha*) and the level of complete health and happiness (*anandamaya kosha*). In this description the physical level and physical part (of the body) (*sthula sharira*) are the same. The levels of subtle energy, emotional and rational thinking form the 'subtle inner part' (*sukshma sharira*) and the level of complete health and happiness is the causal body (*kaarana sharira*). A balance between these three parts (*shariras*) is believed to be necessary for complete health.

Swami Vivekananda Yoga Research Foundation, Bangalore is an established yoga center specializing in yoga education and using yoga as a therapy. The institute has developed an integrated yoga program based on the principles mentioned above and the 'eight limbed yoga' (*astanga yoga*) of Sage *Patanjali* which acts at different levels of existence. These eight 'limbs' are: (i and ii) rules for good conduct (*yamas* and *niyamas*), (iii) physical

postures (*asanas*), (iv) voluntarily regulated breathing (*pranayama*), (v) sensory withdrawal (*prathyahara*), (vi) focused thinking (*dharana*), (vii) meditation (*dhyana*) and (viii) experience of transcendence (*samadhi*). The practices which act at different levels are as follows: (i) and (ii) act at the level of rational thinking and judgment; (iii) at the physical level; (iv) at the level of subtle life energy; (v) and (vi) at the level of emotional thinking (vii) and (viii) at the level of complete health and happiness. This traditional style of yoga has come to be known as 'Vivekananda Yoga' (8).

### *Vivekananda Yoga Program*

The yoga sessions were conducted in small groups with one teacher for around ten participants. The teachers were trained in the 'Vivekananda system' with a 1-year certificate course. The sessions were for 60 min daily, for 8 days and included: loosening exercises (*shithilikarana vyayama*, 10 min), physical postures (*asanas*, 20 min), voluntarily regulated breathing (*pranayama*, 15 min), and yoga-based guided relaxation (15 min).

Loosening exercises (*Sithilikarana Vyayama*, in Sanskrit) are a set of practices intended to increase mobility of joints and to prepare for the practice of yoga postures. The techniques involve repetitive movements of all the joints from the toes up to the neck. For example, more complex joints such as the shoulder could have movements such as rotation, flexion, extension, abduction and adduction.

For the practice of yoga postures (*asanas*) participants were asked to be in a posture as long as they could with comfort and with normal breathing. The following yoga postures were taught: mountain posture (*tadasana*), lateral arc posture (*ardhakatichakrasana*), hand-to-foot posture (*padahasthasana*), half wheel posture (*ardhachakrasana*), sitting with a sideways twist posture (*vakrasana*), back-stretching posture (*paschimothanasana*), half lotus posture (*ardha-padmasana*), diamond posture (*vajrasana*), camel posture (*ushtrasana*), moon posture (*shashankasana*), crocodile posture (*makarasana*), cobra posture (*bhujangasana*), locust posture (*shalabhasana*), shoulder stand posture (*sarvangasana*), fish posture (*matsyasana*), and corpse posture (*shavasana*). These postures are shown in Fig. 1.

While seated with eyes closed keeping the neck and back as straight as possible, voluntarily regulated breathing techniques (*pranayamas*) were practiced where the nostrils were manipulated by adopting a specific hand gesture (*mudra*) where the index finger and middle fingers were flexed against the palm keeping the thumb and other fingers extended. The ring and little finger were used to regulate the breathing through the left nostril while the thumb was similarly used for the right nostril.

For right nostril yoga breathing (*surya anuloma viloma*) and left nostril yoga breathing (*chandra anuloma viloma*)

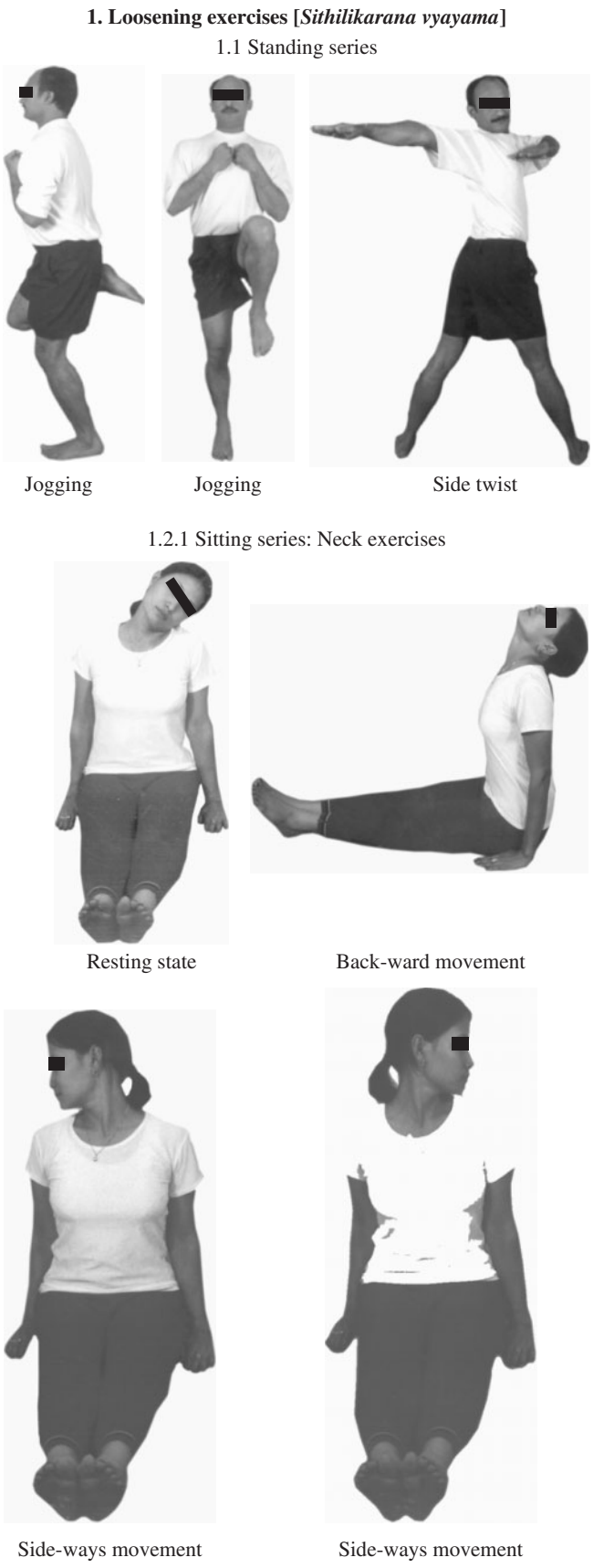



**Figure 1.** Illustration of selected loosening excercises [*sithilikarana vyayama*] and yoga postures [*asanas*].

1.2.2 Sitting exercises: wrist exercises

Wrist movements: upwards

Wrist movements: downwards

Movements of the elbow joints

Exercises for fingers

1.2.3 Sitting series

*Vajrasana*

Forward bending

Backward bending

Tiger stretch-1

Tiger stretch-2

Relaxation in *makarasana*

1.3 Supine series

Straight leg raising-1

Straight leg raising-2

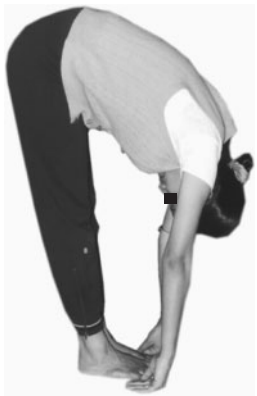
Relaxation in *shavasana*

**2. Yoga postures [*Asanas*]**

*Tadasana*

*ArdhaKatiChakrasana*-Right

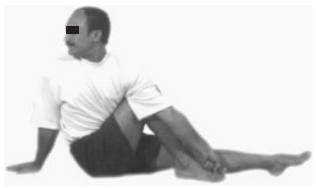
*ArdhaKatiChakrasana*-Left



*Padahasthasana*

*Ardhachakrasana*

**Figure 1.** Continued.



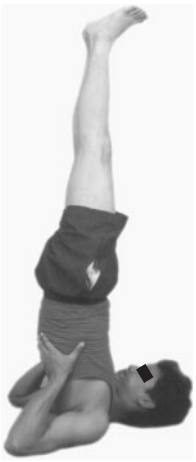
*Vakrasana-Right side*

*Vakrasana-Left side*

*Bhujanagasana*

*Shalabhasana*

*Paschimothanasana*



*Sarvanagasana*

*Matsyasana*

*Ardhapadmasana*

*Vajrasana*

Relaxation in *shavasana*

*Ustrasana*

*Shashankasana*

*Makarasana*

**Figure 1.** Continued.

inhalation and exhalation were exclusively through the right and the left nostril respectively. These were practiced for nine rounds each. During alternate nostril breathing (*nadishudhi*) the practice began with exhalation through the left nostril, inhalation through the same side followed by exhalation and then inhalation on the right side. This was considered as one round and practiced for nine rounds. Bumble bee practice (*brahmari*) involved

exhalation with a humming sound with the mouth closed and the index fingers on either side in the ears. This practice was performed for five rounds. Guided relaxation involved lying in the corpse posture (*shavasana*) and relaxing parts of the body beginning with the toes and moving upwards according to instructions.

These techniques were selected either because previous research showed that they reduced physiologic arousal (9,10) or based on our unpublished, clinical observations.

### Data analysis

The data of the two groups (EP and ML) recorded before and after the yoga intervention were compared for each group separately, with a two-tailed *t*-test for paired data. The correlation between each of the self rated indicators of distress (fear, anxiety, sadness and disturbed sleep) and each of the psycho-physiologic variables (i.e. the heart rate, breath rate and skin resistance) was assessed using the Pearson correlation coefficient test.

## Results

### Visual Analog Scales

The self rated fear, anxiety, sadness and disturbed sleep were significantly less in both EP and ML groups following yoga compared to before ($P<0.05$, for all comparisons).

### Polygraph Data

The participants of both groups also showed a significant decrease in breath rate ($P<0.05$) following yoga. The group average values (SD) are given in Table 1.

### Correlation between VAS and Polygraph Data

There was no significant correlation between the self rated indicators of distress and the psycho-physiological variables recorded using a polygraph.

## Discussion

### Recapitulation of the Results

Self rated indicators of distress (namely fear, anxiety, sadness and disturbed sleep) decreased significantly in all participants after a 1 week yoga camp for tsunami survivors. This was seen for both EP and ML. Also, the breath rate decreased significantly in both groups after yoga.

### Use of Yoga for Post-Traumatic Stress Disorder (PTSD) and Related Conditions

A yoga breathing technique has been used as a public health intervention for survivors of mass disasters, to alleviate post-traumatic stress disorder (PTSD) (11). Apart from this report on the use of yoga breathing for PTSD, yoga practices have been shown to reduce symptoms of emotional distress in different populations. For example, *Kundalini yoga* (KY) meditation was shown to reduce fear in patients with cancer (12).

Yoga practice has also been shown to decrease the time taken to fall asleep, increase the total number of hours slept and the feeling of being rested in the morning, in older persons (13). Improved sleep efficiency, total sleep time, decreased sleep onset latency and reduced wake time after sleep onset in persons with chronic insomnia were reported following yoga practice (14).

### The Basis for the Present Findings

These effects of practicing yoga may explain the benefits of the yoga program in the tsunami survivors reported here. The marginally greater decrease in fear, anxiety, sleep disturbances and sadness in the EP as compared with the ML may be related to differences in the sample sizes of the groups as well as their coping strategies, previous traumatization, education and individual vulnerability. However, of greater importance than the difference between groups (which was not statistically significant) is the fact that both groups showed a significant decrease in symptoms of distress following 7 days of yoga training. However, the fact that the

**Table 1.** Self-rated indicators of distress and autonomic and respiratory variables in tsunami survivors after a week of yoga

| Group | State | Self-rated indicators of distress | | | | Autonomic and respiratory variables | | |
|---|---|---|---|---|---|---|---|---|
| | | Fear | Anxiety | Sadness | Disturbed sleep | Heart rate (beats/min) | Breath rate (breaths/min) | Skin Resistance (in kΩ) |
| Endogenous | Pre-yoga | 7.2 ± 2.3 | 7.4 ± 2.2 | 7.8 ± 2.5 | 6.8 ± 2.7 | 91.5 ± 6.3 | 26.5 ± 7.0 | 671.8 ± 742.8 |
| people $n=16$ | Post-yoga | 3.5***±2.2 | 4.7*±3.0 | 4.8***±3.1 | 3.2***±2.2 | 89.0±12.7 | 20.9*±3.3 | 480.6±520.6 |
| Mainland | Pre-yoga | 7.3 ± 2.0 | 7.6 ± 1.7 | 7.8 ± 2.1 | 7.2 ± 2.2 | 88.1 ± 11.0 | 24.0 ± 7.1 | 394.9 ± 381.6 |
| settlers $n=31$ | Post-yoga | 5.3***±2.2 | 5.3***±2.5 | 6.2***±2.6 | 5.1***±2.3 | 84.9$^{\#}$±9.6 | 20.1***±3.1 | 420.1±383.9 |

$^{\#}P<0.05$, one tailed, $*P<0.05$; $***P<0.001$ *t*-test for paired data, two tailed.

VAS were used rather than validated questionnaires is a limitation of the study.

A decrease in heart rate and breath rate following yoga training has been reported in normal volunteers (15) and in those who have increased psycho-physiological arousal due to their social circumstances, namely. adolescent girls in a remand home (16). The breath rate reduced following 3 weeks of yoga in children with impaired vision (17). The decrease in breath rate in the present study following yoga may be associated with a decrease in psycho-physiologic arousal (18) though no correlation was found between these variables and the self rated fear and anxiety.

## Summary

The present results suggest the use of yoga to reduce stress and derive psycho-physiological benefits in survivors of a major natural disaster. However, given the fact that the study was conducted in a field setting it was not possible to have conventional controls, which is a definite limitation of the study.

## Acknowledgements

The study formed part of a project funded by the Government of the Andaman and Nicobar Islands and the Government of Karnataka, India which is gratefully acknowledged.

## References

1. Thangaraj K, Singh L, Reddy AG, Rao VR, Sehgal SC, Underhill PA, et al. Genetic affinities of the Andaman Islanders, a vanishing human population. *Curr Biol* 2003;13:86–93.
2. Telles S, Dash M, Naveen KV. Emotional impact following the tsunami in endogenous people and mainland settlers in the Andaman Islands. *Indian J Med Sci* 2006;60:70–1.
3. Silver SM, Iacono CU. Factor-analytic support for DSM-III's post-traumatic stress disorder for Vietnam veterans. *J Clin Psychol* 1984;40:5–14.
4. Taimini IK. *The Science of Yoga*. Madras: The Theosophical Publishing House, 1986.
5. Swami Gambhirananda. *Taittiriya Upanishad*. Calcutta: Advaita Ashrama, 1986.
6. Shapiro D, Cook IA, Davydov DM, Ottaviani C, Leuchter AF, Abrams M. Yoga as a complementary treatment of depression: effects of traits and moods on treatment outcome. *Evid. Based Complement. Alternat. Med.* 2007, [Advance Access published on February 28, 2007; doi: doi:10.1093/ecam/nel114].
7. Swami Gambhirananda. *Mandukya Upanisad*. Calcutta: Advaita Ashram, 2000.
8. Monro R, Nagarathna R, Nagendra HR, Ford-Kohne N. *Yoga for Common Ailments*. New York: Simon & Schuster, 1991.
9. Tran MD, Holly RG, Lashbrook J, Amsterdam EA. Effects of hatha yoga practice on the health-related aspects of physical fitness. *Prev Cardio* 2001;4:165–70.
10. Vempati RP, Telles S. Yoga based guided relaxation reduces sympathetic activity judged from baseline levels. *Psychol Rep* 2002;90:487–94.
11. Brown RP, Gerbarg PL. Sudarshan Kriya Yogic breathing in the treatment of stress, anxiety, and depression, Part II-clinical applications and guidelines. *J Altern Complement Med* 2005;11:711–7.
12. Shannahoff-Khalsa DS. Patient perspectives: Kundalini yoga meditation techniques for psycho-oncology and as potential therapies for cancer. *Integr Cancer Ther* 2005;4:87–100.
13. Manjunath NK, Telles S. Influence of yoga and ayurveda on self rated sleep in a geriatric population. *Indian J Med Res* 2005;121:683–90.
14. Khalsa SB. Treatment of chronic insomnia with yoga: a preliminary study with sleep-wake diaries. *Appl Psychophysiol Biofeedback* 2004;29:269–78.
15. Telles S, Nagarathna R, Nagendra HR, Desiraju T. Physiological changes in sports teachers following 3 months of training in yoga. *Indian J Med Sci* 1993;47:235–8.
16. Telles S, Narendran S, Raghuraj P, Nagarathna R, Nagendra HR. Comparison of changes in autonomic and respiratory parameters of girls after yoga and games at a community home. *Percept Mot Skills* 1997;84:251–7.
17. Telles S, Srinivas RB. Autonomic and respiratory measures in children with impaired vision following yoga and physical activity programs. *Int J Rehab Health* 1999;4:117–22.
18. Ax AF. The physiologic differentiation between fear and anger in humans. *Psychosomatic Med* 1953;15:433–42.

Received January 1, 2007; accepted May 08, 2007