



Contents lists available at ScienceDirect

Journal of Ayurveda and Integrative Medicine

journal homepage: <http://elsevier.com/locate/jaim>

Yoga Research

Original Research Article (Clinical)

Design and validation of Integrated Yoga Therapy module for Antarctic expeditioners



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ARTICLE INFO

Article history:

Received 20 July 2017

Received in revised form

27 October 2017

Accepted 18 November 2017

Available online 29 January 2019

Keywords:

Yoga module

Antarctica

Stress

IAYT

ABSTRACT

Background: Extreme environments are inherently stressful and are characterized by a variety of physical and psychosocial stressors, including, but not limited to, isolation, confinement, social tensions, minimal possibility of medical evacuation, boredom, monotony, and danger. Previous research studies recommend adaptation to the environment to maintain optimal function and remain healthy. Different interventions have been tried in the past for effective management of stress. Yoga practices have been shown to be beneficial for coping with stress and enhance quality of life, sleep and immune status.

Objective: The current article describes preparation of a Yoga module for better management of stressors in extreme environmental condition of Antarctica.

Materials and methods: A Yoga module was designed based on the traditional and contemporary yoga literature as well as published studies. The Yoga module was sent for validation to forty experts of which thirty responded.

Results: Experts (n = 30) gave their opinion on the usefulness of the yoga module. In total 29 out of 30 practices were retained. The average content validity ratio and intra class correlation of the entire module was 0.89 & 0.78 respectively.

Conclusion: A specific yoga module for coping and facilitating adaptation in Antarctica was designed and validated. This module was used in the 35th Indian Scientific expedition to Antarctica, and experiments are underway to understand the efficacy and utility of Yoga on psychological stress, sleep, serum biomarkers and gene expression. Further outcomes shall provide the efficacy and utility of this module in Antarctic environments.

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1. Introduction

Characteristics and determinants of human response to extreme environmental conditions prevailing in the Antarctic continent has interested psychologists and physiologists. Extreme environments are inherently stressful and are characterised by a variety of physical and psychosocial stressors including but not

limiting to capsule environment, isolation, social tensions, boredom, monotony and danger [1]. The international committees, COMNAP (The Council of Managers for National Antarctic Program) and SCAR (Scientific Committee of Antarctic Research), in addition to the organisers of the expedition from individual countries, are primarily concerned to enhance the overall well-being of the members sent to the Antarctic stations. Even though scientific research is the primary goal of Antarctic expedition, equal importance is given to take care of the physical and psychological health of the expeditioners starting from selection of expeditioners to emergency evacuation to involving behavioural

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Peer review under responsibility of Transdisciplinary University, Bangalore.

scientist and psychologists to offering periodic support through online group or individual psychological counselling sessions for helping expeditioners deal with the stress [2].

Several psychological and physiological changes are observed in Antarctic expeditioners. Psychological changes range from behavioural changes like aggression, mood swings to psychiatric problems like depression [3]. Isolation seems to have a considerable effect. Isolation and inherent danger associated in Antarctic environment might enhance the extent of repetitive negative thinking based on the personality of the individual. Reports suggest an increase in smoking, loneliness, homesickness and a reduction in rapport during the isolated dark winter months [4]. Physiologically, decreased immune responsiveness accompanied with variations in circulating insulin, thyroid stimulating hormones, testosterone, cortisol, melatonin, pro-inflammatory Cytokines, 25-OH-vitamin D and a significant increase in total cholesterol have been recorded [5–8]. Some studies also suggest that such challenging environments also turn to be *salutogenic* in certain individuals. With limited access to health care in the Antarctic environment, strategies are required to be adopted to promote overall psycho-physical wellness of an individual and also the group. Interestingly, Yoga practices have been known to be beneficial and promote psycho-physiological wellbeing across human cultures.

Physical postures (*asana*), voluntarily regulated breathing (*pranayama*), and meditation (*dhyana*) are the three main components of Yoga practiced in India over thousands of years. In the past decade, Yoga has gained popularity as a fitness strategy and as well as an adjunct therapeutic tool in the management of obesity [9], diabetes [10], hypertension [11] and even auto-immune disorders [12]. Yoga practices have been shown to alleviate anxiety, fear [13,14], negative thinking [15], and enhance cardio-pulmonary fitness [16], immune status [17,18], and also telomere length [19] in regular practitioners. Yoga practices improve the overall sleep efficiency and total sleep time [20]. Yoga practice in high altitudes showed a lower reduction in oral temperature and lower increase in Oxygen consumption and energy expenditure compared to physical therapy [21]. Meta-analysis of data on Yoga recommend Yoga to be considered as an ancillary treatment option in the management of depressive disorders [22].

A study was conducted on the summer and wintering over members of the 35th Indian Scientific Expedition Members to Antarctica to understand the role of Yoga practices on facilitating human adaptation to extreme climatic conditions. Even though Yoga practices are known to be beneficial for individuals irrespective of their health and disease states, it is essential to structure specific Yoga practices that are intended to provide most benefits. Yoga practices for Antarctica were designed with the following objectives:

- i. To regulate mood and alleviate psychological stress caused due to isolation
- ii. To enhance physical wellness, overcome fatigue and regulate metabolism
- iii. To enable better thermoregulation
- iv. To enhance better sleep and promote interpersonal relationship

The objectives were listed based on the earlier reports on the psychological and physiological changes in Antarctic expeditioners. Practices identified were compiled together to promote calmness of mind and sleep, overcome stress and fatigue, promote overall endurance of the body, regulate digestion, metabolism and enable better pulmonary functions (supplementary material 1). The current study present the data on the designing and validation of the Yoga module that was implemented in the expedition members.

2. Materials and methods

The classical and contemporary yoga texts were reviewed to develop the content of the Yoga module. Texts on *Yoga Sutras of Patanjali*, *Hatha Yoga Pradipika*, *Shiva Samhitha*, *Gheranda Samhita*, *Hatharathnavali*, *Bhagavad Gita*, *Upanishads*, *Yoga Vashishta* and *Yogic Sukshma Vyayama* were reviewed [23–31]. Practices that might be difficult for the expeditioners to practice and those that are contra-indicated in common disorders such as hypertension and cardiovascular disorders were not included. Similarly, those practices that were difficult to objectively verify and certain *Sūkshma vyāyāma* (loosening exercise) practices that might not be feasible to practice in group inside the Antarctic stations like *Jangha Shakti vikasaka* [31] were not included. The Yoga module that was designed consisted of postures with slow movements and breath awareness, loosening exercises, *suryanamaskara*, *asana*, *praëayama*, relaxation and *nadanusandhana*. The duration of the entire practice is 1 h.

The Yoga module was sent along with the objectives to forty yoga experts out of whom thirty responded with their scores and comments. Members with allopathic & AYUSH streams of medicine with post graduate medical degree in Yoga therapy, researchers with doctoral degree in yoga, and yoga & naturopathic physicians with over 7 years of clinical experience were considered to be included in the expert panel for validating the Yoga module. The experts rated the usefulness of the module on a scale of 1–5 (1 not at all useful, 2 a little useful, 3 moderately useful, 4 very useful, 5 extremely useful). Content Validity Ratio (CVR) for suitability of items was calculated following Lawshe's method [32]. Dichotomous (yes/no) responses were obtained to determine the duration of the individual practice and the entire yoga session.

2.1. Statistical analysis

Lawshe's CVR ratio was calculated [32] for each item in the module. Items with a CVR of 0.6 and above were considered beyond change agreement ($p < 0.05$, one tailed) for 30 experts. Intra class correlation was calculated for inter-rater reliability [33].

3. Results

Thirty experts in Yoga therapy and research consented to contribute to the content validation of the Yoga module for extreme Antarctic environmental conditions. These Yoga experts had experience in various traditions of Yoga. The experts age ranged from 32 to 50 years (mean 36.3 ± 4.17 years). The average experience following formal yoga training was 12.3 years ranging between 8 and 26 years. The scores obtained for the individual practices and the calculated CVR are shown in the supplementary material 2. One practice *viparitarani* with CVR < 0.6 was excluded. The average CVR for the entire Yoga module was 0.89. Good agreement is noted for most practices listed in the yoga module. Intra Class Correlation [33] for the entire module was 0.78.

All the experts opined on the need for practicing *Suryanamaskara* (sun salutation), relaxation and breath awareness based practices and *pranayama*. Most experts agreed on the duration of 1 h for the Yoga practices (Table 1). In addition to the practices that were asked to be scored by experts, seven experts recommended to include *vaman dhauti kriya* (voluntarily induced vomiting after drinking saline water in empty stomach). But, was not considered in module due to challenges in water treatment and discharge at Antarctica.

Table 1
List of Practices.

Practices
<i>Sūkṣma vyāyāma [7min]</i>
Grīvā śakti vikāsaka
Aṅguli śakti vikāsaka
Maṅibandha śakti vikāsaka
Kāraprastha śakti vikāsaka
Kati śakti vikāsaka i & ii
Jānu śakti vikāsaka
Piṅḍali śakti vikāsaka
Gulpha – pāda – prastha – pāda – tala – śakti – vikāsaka
Instant relaxation technique
Sūryanamaskāra [6 rounds/12 min]
Quick relaxation technique [3 min]
<i>Yogāsanaḥ & Others [15 min]</i>
Ardhakati cākṛāsana
Trikoṇāsana
Parivṛtta trikoṇāsana
Pārśvakoṇāsana
Vajrāsana
Uṣṭrāsana
Paścimottānāsana
Vakrāsana
Ardha matsyendrāsana
Bhūnānāsana
Cakki cālānā
Bhūjaṅgāsana
Setubandhāsana
<i>Prāṇāyāma [14 min]</i>
Vibhāgiya śvasana
Kapālabhāti kriyā [60 strokes]
Nāḍi śuddhi prāṇāyāma [6 rounds]
Bhrāmari [9 rounds]
<i>Meditation [9 min]</i>
Nādānusandhāna / AUM chanting

4. Discussion

The Yoga module for application in the extreme Antarctic conditions appears to be acceptable for most of the experts. Similar strategy was used in earlier studies for validating yoga modules for various pathological conditions [34,35].

The experts from different schools of yoga were in agreement with the contents of the module. Only *viparītakarāni* was not favoured to be included in the final module as indicated by the CVR score (<0.6). Seven experts suggested including *vaman dhauti kriya*. However, with concerns over processing the waste water and maintenance in the Antarctic stations and the decision of experts not being unanimous, the recommendation was not taken further into validation.

Several interventions like psychiatric counselling, group therapy, medications and diet are tried on the expeditioners to reduce their psycho-physiological stress. Yoga, a widely accepted reliever of stress [36], has never been tried in Antarctica until now. Also, the

strengths of this module is that it consists of simple postures that are easy to follow and as the practices are derived from traditional yoga texts, yoga instructor following any school of Yoga should be able to teach the module. The classical Yoga texts does not describe specific symptom based guidelines for their practice – as the primary objective of Yoga practices is to gain mastery over mind [26] and the observed physical and mental benefits might be actual by-product of yoga practice. Therefore, the practices have been selected from the texts based on the approximating descriptions of mental and physical health benefits of specific Yoga practices and that are feasible to be practiced at the Indian Antarctic station. This is the first attempt made to administer structured Yoga practices with an objective to understand its mechanisms of action in isolated, stressful and extreme Antarctic conditions. The effect of the Yoga intervention will be known when the study on the summer [Voyage team] and wintering over [Bharati, Larsemann hills, (69°24'28"S 76°11'14"E)] members of the 35th Indian Scientific Expedition to Antarctica will be analysed for changes in their psychological stress, sleep, serum biomarkers, and gene expression regulations.

5. Conclusion

A comprehensive and traditional text based Yoga module was developed as an intervention to facilitate coping up with the psychological and physiological stressors in the Antarctica. The Yoga module was validated by 30 experts who agreed to most of the practices. The final module was used as an intervention in the 35th Indian Scientific Expedition to Antarctica. Testing of efficacy of the intervention on alleviating psycho-physiological stress at genetic and molecular level is underway and might prove to be an efficient way to deal the stressors associated with the extreme Antarctic environments.

Sources of funding

Defence Institute of Physiology and Allied Sciences, New Delhi (TC/DIP-265/CARS-05/DIPAS/2-15).

Conflict of interest

None.

Acknowledgments

The authors acknowledge all the experts for offering their comments and inputs to develop this module.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jaim.2017.11.005>.

References

- [1] Suedfeld P. Applying positive psychology in the study of extreme environments. *Hum Perform Extreme Environ* 2001;6. p 21–5.
- [2] Suedfeld P, Steel GD. The environmental psychology of capsule habitats. *Annu Rev Psychol* 2000;51. p 227–53.
- [3] Gunderson EKE. Emotional symptoms in extremely isolated groups. *Arch Gen Psychiatr* 1963;9. p 362.
- [4] Bhargava R, Mukerji S, Sachdeva U. Psychological impact of the Antarctic winter on Indian expeditioners. *Environ Behav* 2000;32. p 111–27.
- [5] Muller HK, Lugg DJ, Ursin H, Quinn D, Donovan K. Immune responses during an Antarctic summer. *Pathology* 1995;27. p 186–90.
- [6] Sawhney RC, Malhotra AS, Prasad R, Pal K, Kumar R, Bajaj AC. Pituitary-gonadal hormones during prolonged residency in Antarctica. *Int J Biometeorol* 1998;42. p 51–4.

- [7] Farrace S, Cenni P, Tuozzi G, Casagrande M, Barbarito B, Peri A. Endocrine and psychophysiological aspects of human adaptation to the extreme. *Physiol Behav* 1999;66. p 613–20.
- [8] Steinach M, Kohlberg E, Maggioni MA, Mendt S, Opatz O, Stahn A, et al. Sleep quality changes during overwintering at the German antarctic stations neumayer II and III: the gender factor. *PLoS One* 2016;11, e0144130.
- [9] Bernstein AM, Bar J, Ehrman JP, Golubic M, Roizen MF. Yoga in the management of overweight and obesity. *Am J Lifestyle Med* 2014;8. p 33–41.
- [10] Nagarathna R, Usharani MR, Rao AR, Chaku R, Kulkarni R, Nagendra HR. Efficacy of yoga based life style modification program on medication score and lipid profile in type 2 diabetes—a randomized control study. *Int J Diabetes Dev Ctries* 2012;32. p 122–30.
- [11] Hagins M, States R, Selve T, Innes K. Effectiveness of yoga for hypertension: systematic review and meta-analysis. *Evid base Compl Alternative Med* 2013;2013. p 649836.
- [12] Dash M, Telles S. Improvement in hand grip strength in normal volunteers and rheumatoid arthritis patients following yoga training. *Indian J Physiol Pharmacol* 2001;45. p 355–60.
- [13] Smith C, Hancock H, Blake-Mortimer J, Eckert K. A randomised comparative trial of yoga and relaxation to reduce stress and anxiety. *Compl Ther Med* 2007;15. p 77–83.
- [14] Telles S, Naveen KV, Dash M. Yoga reduces symptoms of distress in tsunami survivors in the Andaman Islands. *Evid base Compl Alternative Med* 2007;4. p 503–9.
- [15] Frewen PA, Evans EM, Maraj N, Dozois DJA, Partridge K. Letting go: mindfulness and negative automatic thinking. *Cognit Ther Res* 2008;32. p 758–74.
- [16] Raub JA. Psychophysiological effects of Hatha yoga on musculoskeletal and cardiopulmonary function: a literature review. *J Alternative Compl Med* 2002;8. p 797–812.
- [17] Jiang Q, Li A, Zhang X. Research on the effect of yoga on the IgG level of college students. *J Mianynag Norm Univ* 2009;5.
- [18] Rao RM, Nagendra HR, Raghuram N, Vinay C, Chandrashekhara S, Gopinath KS, et al. Influence of yoga on mood states, distress, quality of life and immune outcomes in early stage breast cancer patients undergoing surgery. *Int J Yoga* 2008;1. p 11–20.
- [19] Epel E, Daubenmier J, Moskowitz JT, Folkman S, Blackburn E. Can meditation slow rate of cellular aging? Cognitive stress, mindfulness, and telomeres. *Ann N Y Acad Sci* 2009;1172. p 34–53.
- [20] Khalsa SBS. Treatment of chronic insomnia with yoga: a preliminary study with sleep-wake diaries. *Appl Psychophysiol Biofeedback* 2004;29. p 269–78.
- [21] Selvamurthy W, Ray US, Hegde KS, Sharma RP. Physiological responses to cold (10°C) in men after six months' practice of yoga exercises. *Int J Biometeorol* 1988;32. p 188–93.
- [22] Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. *Depress Anxiety* 2013;30. p 1068–83.
- [23] Müller FM, Friedrich M. Upanishads: the holy spirit of Vedas: earliest philosophical compositions also known as Vedanta. Vijay Goel; 2007.
- [24] Swami SP. The Bhagavad Gita, vol. 19. Books Abroad; 1945. p. 150.
- [25] Iyengar BKS. Light on the Yoga Sutras of Patanjali. Harper Collins; 1996.
- [26] Taimni IK, Iqbal K, Patanjali. The science of yoga: the yoga sutras of Patanjali. Theosophical Publishing House; 1999.
- [27] Satyananda Saraswati S. Four chapters on freedom: commentary on Yoga sutras of Patanjali. Yoga Publications Trust; 2002.
- [28] Gharote ML, Devnath P, Jha VK. Srinivasayogi active 17th century. India: Hatharatnavali. Lonavala Yoga Institute; 2002.
- [29] Muktibodhananda SS, Satyananda SS. Hatha yoga Pradipika. Bihar, Yoga Publications Trust; 1998.
- [30] Niranjanananda Saraswati S. Gheranda Samhita. Bihar, Yoga Publications Trust; 2012.
- [31] Brahmachari Dharendra. Yogic suksma vyayasama. Illustrated. Indian Book Company; 1975.
- [32] Lawshe CH. A Quantitative approach to content validity. *Person Psychol* 1975;28. p 563–75.
- [33] Harris JA. On the calculation of intra-class and inter-class coefficients of correlation from class moments when the number of possible combinations is large. *Biometrika* 1913;9. p 446–72.
- [34] Kakde N, Metri KG, Varambally S, Nagaratna R, Nagendra HR. Development and validation of a yoga module for Parkinson disease. *J Compl Integr Med* 2017;14.
- [35] Varambally S, Varambally P, Thirthalli J, Basavaraddi I, Gangadhar B, Hariprasad V. Designing, validation and feasibility of a yoga-based intervention for elderly. *Indian J Psychiatr* 2013;55. p 3442.
- [36] Li AW, Goldsmith CAW. The effects of yoga on anxiety and stress. *Altern Med Rev* 2012;17. p 21–35.