

Breath Based Meditation to Reduce Stress Related Chronic Diseases and Enhance Well-Being

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Abstract

This review of published literature presents compelling clinical evidence for the treatment of multiple psychological and physical conditions using breath-based meditation. Established biological effects and clear mechanisms of action confer the capacity for this simple technique to deliver profound clinical results in various disease conditions. The volume of high quality relevant data is sufficient to speculate that meditation could be a viable complementary alternative in the management of chronic and depressive conditions. There is also significant data highlighting the potential for breath based meditation to prevent stress related chronic diseases and enhance well-being.

Keywords: Meditation; Health; Depression; Stress; Quality of Life; Therapeutics

Introduction

Breath-based meditation techniques have ancient roots in various spiritual and religious practices. Hindus, Buddhists, Taoists and other traditions have utilized the combined power of breath and meditation for physical, psychological, emotional and spiritual wellbeing for thousands of years.

Modern epidemics of lifestyle disease, depressive disorders and dissatisfaction with allopathic medicine are driving a rediscovery of this ancient wisdom and its proven ability to enhance wellbeing. The stress, diet and environmental triggers for chronic diseases are, by their very nature, often reversible and almost always preventable. Epigenetic revelations indicate that individual choices are far more responsible for disease than many patients, or doctors, are ready to accept.

This article presents scientific evidence (published in peer-reviewed journals and delivered by clinical experts in their field) to support a practical breath-based meditation technique which can be used to enhance total wellbeing and delay the onset of clinical disease expression (thereby preventing it) and be used as a therapeutic intervention. Evidence for the beneficial effects of Sudarshan Kriya Yoga (SKY) are reported along with limitations and issues with protocols and study designs. Analyzing the physiological, psychological, biochemical, hormonal, genetic and behavioral mechanisms underlying the observed effects corroborates the potential for a new era of therapeutic meditative interventions which are life-saving, cost effective and virtually side effect free.

Breath-based meditation to reduce stress

One popular breath based meditation technique, Sudarshan Kriya Yoga (SKY) combines sequences of breath-control practices (pranayama) with rhythmic breathing, and relaxation. The sequence combines multiple ancient meditative practices and was developed

in the early 1980's. Study results clearly demonstrate reductions in anxiety, depression and stress with evidence to show enhanced immune function and increased feelings of wellbeing.

The SKY meditation combines yogic breathing patterns which are both physiologically stimulating and relaxing. A wide range of beneficial physiological and psychological effects have been observed which enhance both cognitive and physical performance and whole body wellbeing with biochemical, neuroendocrine, genetic and cellular effects [1]. Compared to other forms of meditation, SKY is relatively simple to learn and is taught in a community setting by qualified teachers.

Sudarshan Kriya Yoga meditation

SKY uses cyclical and rhythmic breathing to guide practitioners into a state of meditation and relaxation. Literally translated, "Sudarshan" means proper vision and "Kriya" means purification of the body - which hints at the wide-ranging benefits that have been established. The entire sequence of the practice can be done in as little as 20 - 30 minutes. There are no known (or published in scientific literature) side-effects associated with the practice when taught by a qualified teacher. The practices are relatively gentle and utilize natural rhythms of the breath, similar to those experienced during light exercise or very mild hyperventilation. Typically, yogic and meditative interventions like SKY are well tolerated in elderly populations [2]. Further studies are needed to understand the physiological effects in individuals with late stage and advanced medical conditions.

The clinical use of meditation and yoga has increased significantly over the past three decades: demonstrated by the frequency with which randomized and controlled trials are being published reporting their beneficial effects [3]. Initially the majority of research was reported in Indian journals, but there has been a steady increase in studies being carried out in the UK and US and reported in mainstream scientific publications [3].

While there is strong evidence to support the benefits of meditative practices in healthy individuals, the collection of data for therapeutic effect is more limited. However, there are several key areas in which the clinical application is being actively studied. Symptoms of psychopathological conditions such as post-traumatic stress disorder (PTSD), emotional trauma and depression are being effectively treated with SKY [4].

Post-traumatic stress disorder and breath based meditation

Multiple studies have demonstrated clinically significant outcomes when treating PTSD. Significant reductions in core PTSD symptoms (stress, anxiety, insomnia and depression) were seen when SKY practices were taught after traumatic events such as war, terrorism or natural disasters. After Hurricane Katrina survivors taught SKY practices reported they were less tense, felt less aggressive, had better sleep quality, more energy and an enhanced self-image [5]. Similar positive results from SKY meditation have been observed globally during trauma relief efforts in Russia, South East Asia, Europe, and the Middle East, indicating there is no social or cultural bias to the positive effects which can be experienced [5].

Trauma as a result of the collapse of the World Trade Center (September 11th 2001) was significantly reduced with SKY practice. Rapid and sustained improvements were seen in both psychological and physiological symptoms (insomnia, nightmares, anxiety, depression, hyper arousal, over reactivity to triggers, re-experiencing, emotional numbing, social withdrawal, loss of appetite and angry outbursts) [6].

SKY is cost-effective and a preferable treatment for trauma victims who do not want the stigma of seeking traditional psychiatric treatment. It can be quickly deployed at target locations and enhances group morale and individual empowerment.

A study assessing the treatment of longstanding PTSD in Australian Vietnam war veterans compared Iyengar yoga, Desikachar yoga, Qi Gong, SKY, and a multicomponent yoga intervention (MCYI). Results indicated that both SKY and MCYI had the greatest efficacy with a significant decrease in Clinician Administered PTSD Scale (CAPS) [7].

SKY is effective in reducing the cognitive distortions ('emotional wounds') resulting from PTSD (feeling alone, abandoned, and cast out by society). Practices support participants to feel accepted and valued within their community [8].

Breath based meditation, depression and anxiety

A randomized study of 45 hospitalized patients compared the antidepressant efficacy of SKY to Electroconvulsive Therapy (ECT) and imipramine in melancholic depressives. The prospective trial compared SKY to standard treatment options for untreated patients. The four week intervention included weekly assessments and results showed significant reductions for total Beck Depression Inventory (BDI) scores and Hamilton Rating Scale for Depression (HRSD) in all three treatment groups [9]. Final remission rates (defined as HRSD of seven or less) was 67% for the SKY therapy, compared to 97% for ECT and 73% for medication. Although the study design was limited by a lack of double blind conditions, SKY shows strong potential for complementary alternative to a pharmaceutical interventions or hospitalization [9]. The antidepressant effects of SKY meditation were demonstrated in a 2 week controlled study of 60 inpatients with alcohol dependence (who volunteered for an abstinence program) [10].

Psychological assessments using the Beck Depression Inventory (BDI) and physiological testing of cortisol, ACTH and prolactin were carried out before and two weeks after the study. While both groups showed improvements in BDI and changes to physiological profiles, the significant reductions in BDI, cortisol and ACTH were only seen in the treatment group. Additionally, there was a correlation between reduced cortisol levels and improving BDI score in the group treated with alternate-day supervised SKY practice [10]. A 6-month study investigating SKY therapy as an adjunct therapy for psychiatric disorders in a Caucasian population demonstrated that SKY significantly reduces anxiety and depression scores. The participants were provided with an intense 10-day workshop as adjunct therapy and were required to complete a simplified daily individual and independent practice of 30 minutes [11]. Participants were initially assessed during recruitment, after two weeks, then at three and six month intervals. Psychological assessments were done using Hamilton Rating Scale for Anxiety (HRSA), Hamilton Rating Scale for Depression (HRSD), Zung Self-Rating Anxiety Scale (ZSAS), Zung Self-Rating Depression Scale (ZSDS) and Symptom Checklist-90 (SCL-90). The various assessment scales showed significant convergence and all clearly demonstrated the effectiveness of the therapy which resulted in a long-plateau with a virtually zero score for anxiety or depression [11].

A controlled study of 46 patients with anxiety or depression disorders received either conventional therapy (control group) or conventional therapy combined with SKY practice (treatment group). Treatment lasted 15 days and levels of anxiety and depression were measured with quantitative questionnaires. Cardiac Autonomic coupling (CAC) and cardiorespiratory coupling was also analyzed using autoregressive spectral analysis [12]. The results after 15 days showed reduction in levels of anxiety and depression in the treatment group only. Additionally parasympathetic modulation and cardiorespiratory coupling were significantly higher in the treatment group. Results suggest SKY would be an effective non-pharmaceutical intervention for anxiety and depressive disorders and also reduce cardiovascular risk in these patient populations [12].

Hypertension and breath based meditation

A 2-month open-label SKY intervention on 26 mildly-hypertensive patients and 26 apparently healthy adults reported significant decreases in diastolic blood pressure ($P < 0.01$). There was no change in blood pressure for the healthy adults, indicating the therapeutic effect was "counteractive" or normalizing in nature and not mediated by a specific drug-like action [13].

Physiological mechanisms of breath based meditation

Three data-driven potential and possibly cumulative, mechanisms of action explain many of the beneficial effects of SKY meditation.

Correlating SKY practices to existing research on slow breathing, vagal nerve stimulation, and meditation has identified mechanisms which underlie the physiological observations and psychological benefits. The first stage of SKY (slow, inspiration and expiration) increases airway resistance, reduces airflow, elevates intra-thoracic pressure, changes blood pressure and carbon dioxide (CO₂) levels, resulting in increased brain perfusion [14]. Practitioners are trained to increase tidal volume, preventing tendency towards hypoxia or hypercapnia which would normally be expected during prolonged voluntary slow breathing (also highlighting the need to be effectively trained in the practices).

In the wild, animals naturally enter a similar respiratory state after defeat in battle. This drives enhanced vigilance, mediated by the hypothalamus, as a protection mechanism for when both fight and flight have failed. During this time animals also need to restore energy to prepare for more activity and the enhanced cerebral blood flow ensures they can process data from their environment reducing risk of being finished off by the victor. Subjectively, people feel attentive and relaxed after this stage in the SKY practice.

The second stage of SKY (forceful rapid breaths) results in central nervous system (CNS) excitation with EEG recordings highlighting a 26 to 33 Hz sinusoidal rhythm and paroxysmal activity mimicking patterns seen during orgasm [15,16]. Subjectively, the experience is of stimulation followed by relaxation. Vasoconstriction as a result of the hyperventilation reduces cerebral blood flow (up to 50%), creating a depressant effect corroborated by slow wave states observed with EEG [17].

Increased voluntary ventilation has multiple neurological and physiological effects including increasing hippocampal neuron excitability; increased cardiac output and renal blood flow coupled with increased lithium and sodium excretion; and quieting of frontal and parieto-occipital cortex [18-21]. The cognitive and emotional effects of hyperventilation are known to include decreased attention and cognitive function plus changes to operant emotional cognition [22,23]. Practitioners experience a feeling of surrender coupled with excitement [14].

The 'edge of sleep' state experienced after completion of the second stage allows suppressed emotions to arise as a result of cortical disinhibition (under thalamocortical regulation) and retraumatization is reduced as individuals are calm and relaxed [24]. A pilot study of Art of Living SKY teachers highlighted increased beta activity in the left parieto-occipital region coupled with increased alpha waves explaining the perception of increased calmness and relaxation combined with vigilance and attention [25].

SKY combines the effects of verbal stimulation and vibration which activate Wernicke's area and the thalamus [14]. Adept yogic meditators experience physiological changes (decreased metabolism and slower heart rate), so there are potentially other mechanisms at work [26]. Continued SKY practice increases dopamine stimulation (via mesolimbic reward systems) resulting in experiences of joy and bliss even during negative sensory input [14]. The combined stages of SKY meditation result in rapid and significant hormonal changes. Prolactin (typically associated with human breast milk production and infant bonding, but also associated with immune regulation and reproduction) is elevated after a single practice [27].

The hypothalamic pituitary adrenal (HPA) stress and survival response, mediated by glucocorticoids and primarily cortisol, is often abnormal in people with depression and PTSD with strong (cortisol-linked) association with risk of relapse for alcohol dependent individuals [10,28]. Several studies have measured reductions in cortisol which have been correlated with reductions in depression score [29].

In a 3-month controlled pain management study (147 patients with advanced breast cancer) there was a significant reduction in pain perception and cortisol level. The intervention group received standard care (pharmaceutical pain management) plus 18 hours of SKY training and 20 minutes of daily personal practice at home, the control group received standard care only. Mean blood cortisol levels measured at the end of the study were: 341.2 ng/ml in the intervention group versus 549.2 ng/ml in the control group ($P \leq 0.002$) [30]. Increases in production of vasopressin are typically seen with hyperventilation and a fivefold increase is reported during meditation. There is limited evidence suggesting that vasopressin is decreased in depressed individuals, potentially due to the collocation of oxytocin receptors [14]. It is speculated that the hormone oxytocin (which promotes social bonding in mammals and is involved with sexual arousal) plays a complex role in multiple mood and anxiety disorder and may be enhanced during SKY meditation [14,31].

Increased expiration of thiobarbituric reactive acid substances (TBARS) may explain some of the meditation's beneficial anti-oxidant effects [14]. Significant reductions in plasma malondialdehyde adducts (MDA), a commonly used biomarker for lipid peroxidation and serum urea, were seen in mildly hypertensive patients treated with SKY therapy providing biochemical evidence for its detoxification effects [13]. The intense breathing is thought to increase the expiration of oxidative metabolic by products, enhancing detoxification, and enhancing the body's own antioxidants. Increased renal output is another route by which detoxification may be enhanced.

Chronic disease symptom management and breath based meditation

The progression from healthy states to clinically significant chronic disease is not typically as a result of a single event. Unlike trauma resulting from a car accident or broken bone, lifestyle diseases are the result of a gradual increase in physiological imbalance. For example, Type II Diabetes: which starts with a pre-diabetic state of mild insulin resistance and gradually progresses to a clinically significant disease confirmed by physiological tests [32]. Many diseases incubate for years before patients or clinicians become aware and there is increasing evidence that nutrition, activity levels and environmental toxins lead to physiological disturbances. Inflammation, oxidative stress, metabolic disturbances and hormone imbalances are seen in cancer, diabetes, autoimmune diseases, inflammatory bowel conditions, mood disorders, cardiovascular conditions and many more. Oxidative stress is gaining increasing attention as a key mediator of disease caused by an imbalance in the body's ability to manage the prooxidant-antioxidant balance [33]. This implies chronic diseases could be prevented if early stage subclinical biochemistry was managed before pharmaceutical intervention was needed. Managing the physiological indicators of early disease manifestation (combined with supporting immune function) is more powerful and cost effective than waiting for disease to develop.

Without significant changes to their diet, a 2-month SKY study in healthy adults saw significant increase in antioxidant superoxide dismutase ($P < 0.00001$), combined with a marginal reduction in oxidative stress (inferred with plasma MDA) ($P = 0.20$) [34]. A 4 month study of diabetic patients saw reductions in plasma MDA and lipoperoxidation in addition to reductions in blood glucose levels [35]. Levels of blood lactate were reduced and SOD, glutathione, and catalase were increased in a study comparing SKY practitioners with non-practitioners [36]. Improved antioxidant status (identified at the transcriptional level with and via enzyme activity) was also seen in a study of SKY practitioners [37].

Prolonged lymphocytes life-span (through up-regulation of antiapoptotic genes) was seen when studying SKY practitioners, indicating epigenetic transcriptional regulation [38]. Total T-cells, T-helper and NK cells were significantly higher in a study of SKY teachers when compared to control subjects (and cancer patients) [38]. In a study of cancer patients who finished medical therapy the practice of SKY meditation increased NK cells significantly (at both 12 and 24 weeks of practice) compared to baseline [39].

Improvements in pulmonary function and hemoglobin concentration were seen in 8 days of SKY practice, suggesting its potential as an adjunctive (non-pharmacological) tool for managing cardiovascular or respiratory diseases [40]. Improvements in lung function were also seen in healthy adults indicating SKY meditation could complement treatment for obstructive airway diseases including asthma [41]. The reported beneficial cognitive effects could potentially delay the onset or reduce symptoms associated with neurodegenerative and

attention disorders. SKY practitioners show increased mental focus, mental alertness and heightened awareness compared to controls as a result of increased beta activity left frontal, occipital and midline regions [42].

EEG studies testing working memory showed SKY meditators had a more efficient use of energy and power spectral density (PSD) with minimized energy losses, which increased working memory capacity [43]. This has potential therapeutic significance for diseases with abnormal PSD like Alzheimer's, Cerebral Palsy and Autism [44-46]. Stress is a known contributor to chronic disease and stress reduction interventions directly reduce symptoms, situational tolerance and perceived ability to cope with life's events [47]. A 2 month study of 37 apparently healthy adults demonstrated clear reductions in anxiety levels: the daily SKY practices saw significant reductions in anxiety ($P = 0.039$) and stress ($P = 0.017$) with marginal improvement in patience ($P = 0.134$) [34]. Participants also reported: an elevated sense of well-being (67% of subjects), improved sleep quality (50%), and increased enthusiasm for work (33%) [34].

Quality of life and wellbeing

SKY meditation can support patients to improve their general quality of life. Patients living with HIV/AIDS saw significant improvements in qualitative psychological wellbeing immediately after intervention [48]. A study on breast cancer patients post treatment demonstrated: significant improvement in quality of life; enhanced spiritual well-being; positive states of mind and reduced stress perception after SKY training (maintained at 5-week follow-up) [49]. The sheer volume of people who have benefited from SKY has generated a vast set of qualitative data in healthy adults who have experienced subjective improvements to their mental and physical wellbeing. Practitioners report: increased energy; improved sleep quality; more creativity; relaxation and peacefulness; better relationships; enhanced awareness and more confidence.

SKY meditation improves multiple physiological measures of wellbeing (heart rate variability, galvanic skin response, hand skin temperature, pulse plethysmography and blood pressure) and the health of practitioners becomes more robust, developing the capacity to re-balance stressful challenges [50]. The deep and profound effects are not limited to the physical and psychological ones; the introduction of SKY meditation over a 4-day workshop was found to "completely transform the outlook of people toward life" [51]. The meditation has physical, mental and social benefits and paves the way for the 4th dimension of Spiritual Health proclaimed by the World Health Organization (WHO) to be an important element of human wellbeing [52].

Future studies on breath based meditation

More cross cultural studies are needed to better understand the physiological responses to prolonged use of breath based meditation to manage chronic disease and stress. SKY meditation has immense potential to enhance wellbeing, prevent chronic disease and has the potential to be prescribed for early stage interventions once sufficient data has been collected. To date, the convergence of multiple self-assessment psychological scales and physiological datasets are needed to draw firmer conclusions about treatment effectiveness to rival currently prescribed interventions.

Conclusion

If patients were aware of the therapeutic potential SKY has to: treat psychological disorders; prevent the onset of chronic conditions and generally supporting the body to recover wellness, would they choose SKY over expensive, toxic and lifelong progressive polypharmacy allopathic intervention? When it comes to informed consent and the patient's right to choose how their care is managed, they deserve to be presented with breath-based meditative therapies as a viable and simple holistic life-enhancing option.

Informed consent is invalidated when patients are only presented with pharmaceutical options despite mounting evidence that patient-centered treatments like SKY can reduce stress, increase wellbeing and optimize health (without side effects and additional toxic

stressors). If first-line therapies sought to directly resolve the multitude of physiological imbalances caused by stress, inflammation and hypertension by improving respiratory, cardiac and immune function, then many patients would avoid progression into life-threatening symptomatic comorbid states.

SKY demonstrates generalized and varied physiological “rebalancing” effects, not all of which may have well described mechanisms of action. However, 7% of approved drugs have no known primary target, and up to 18% lack the well-defined mechanism of action deemed ‘critical’ for widespread acceptance and approval [53]. Our scientific (and regulatory) requirement to understand how something works is blinding treatment choices. We may be overlooking the much more critical fact that it does work - with relatively high compliance, very low risk, exceptionally low cost and broad spectrum positive effects.

Competing Interests

The authors confirm they have no conflict of interest to declare.

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