



THE SCIENCE of BREATH

Mounting scientific research continues to suggest that health, quality of life, and even the very length of life, are all profoundly affected by our mental and emotional states. The emerging field of mind/body medicine explains how our thoughts and emotions can powerfully affect brain, endocrine (hormone), and immune system function. This influence is facilitated by chemical messengers called neuropeptides, which are released with one's every emotion. They are rapidly picked up by cells in the immune, endocrine, and autonomic nervous systems, and directly affect their functioning.

For example, "positive" emotions, such as joy, love, and enthusiasm, produce chemical messengers that can affect the brain, endocrine, and immune systems in positive ways, resulting in improved resistance to disease and better overall health. In contrast, "negative" emotions, such as anger, fear, and sadness, produce chemicals that can adversely affect the brain, endocrine, and immune systems, resulting in less resistance to disease and poorer overall health. This is how feeling stressed can lead to significant alterations in the physiology, and can contribute to a broad range of diseases, ranging from cancer and cardiovascular disease to asthma, depression, and ulcers.

Processes to Counter Stress

The yogic science of breath is a precise, 5,000+ year-old science of health promotion. It is one of the first sciences to recognize the impact of mind and emotions on creating and restoring optimal health. One of the most comprehensive breathing techniques derived from this science and taught by the Art of Living Foundation is Sudarshan Kriya (SK). Sudarshan Kriya is understood to use specific rhythms of breath to eliminate stress, support the various organs and systems within the body, transform overpowering emotions, and restore peace of mind.

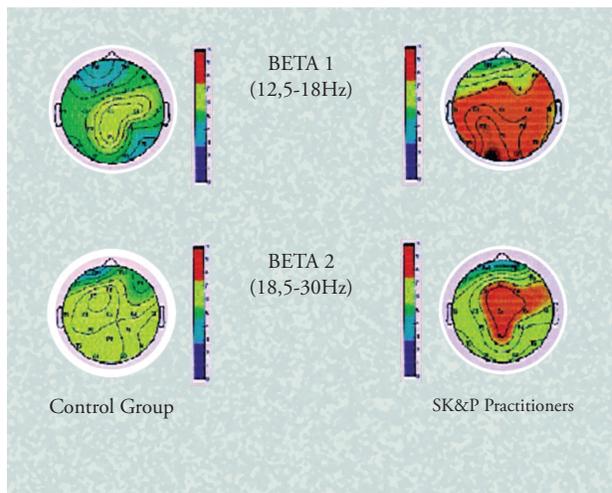
Sudarshan Kriya and its accompanying practices (SK&P) have been taught by the Art of Living Foundation to more than 2 million people worldwide, and continue to be independently investigated by modern medical science at hospitals and research institutions. Following is a summary of some key findings.

Research Summary-Improved Brain Function.

To study the long-term effects of SK&P on brain function, EEG (electroencephalogram) changes were recorded in 19 SK&P practitioners *outside* of the practice of SK&P, and compared with EEG patterns of 16 controls (doctors and researchers who did not practice SK&P, yoga, or meditation). Significant increases in beta activity were observed in the left frontal, occipital, and midline regions of the brain in the SK&P practitioners, as compared to controls ($p < 0.05$). These results are interpreted

by neurologists as indicative of increased mental focus/heightened awareness in SK&P practitioners. It is striking to note that SK&P practitioners displayed significantly greater mental alertness (beta activity) than the control group of physicians and medical researchers, whose profession requires development and daily use of these very skills.

EEG-beta wave measures, indicating increased alertness



EEG activity was also studied *during* the practice of SK&P in five females of similar age, socioeconomic, and educational backgrounds. This study found an increase in EEG alpha activity, with interspersed persistence of beta activity. This indicates a state of relaxation co-existing with heightened alertness.

Effect on Cortisol, the “Stress Hormone”

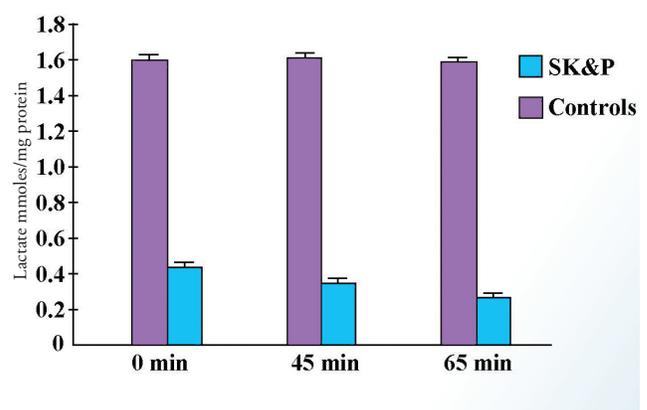
Several studies have demonstrated significant falls in cortisol levels. In one study, blood cortisol, known as the “stress hormone,” was measured in 21 individuals, 35–50 years of age. Regular SK&P practitioners (Group 1) were compared with beginning practitioners (Group 2) during their SK&P sessions. The beginning practitioners were also measured before learning SK&P, while listening to classical music (Group 3). Among

beginners, the fall in cortisol levels was significantly greater during SK&P than when listening to classical music, suggesting that SK&P produces a better relaxation response. Regular SK&P practitioners had significantly lower blood cortisol levels at baseline than beginning practitioners, indicating that they experienced less physiological stress under the demands of daily living. The significant further fall in serum cortisol levels, during and following SK&P, among beginning and regular practitioners, suggests that regular practice of SK&P progressively develops greater levels of both relaxation and resilience to stress.

Effect on Blood Lactate

Blood lactate is another biochemical measure of stress. Participants in police training constitute a highly stressed group. They undergo intense physical and emotional training daily. Blood lactate was measured in 10 such individuals, both before learning SK&P and after the first session. There was a significant fall in lactate levels after

Decreased Lactate (an indicator of tension and stress)



SK&P, suggesting that it induces a state of relaxation.

Effect on Immune Function

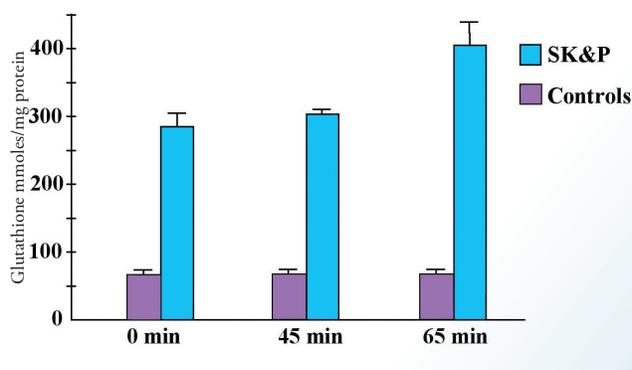
The immune system protects us from disease. Natural killer (NK) cells are the surveillance

cells of the immune system and are capable of destroying tumor cells as well as infected cells. NK cells were counted in the peripheral blood of three groups: SK&P practitioners, normal individuals not practicing SK&P, and cancer patients in remission. NK cells were significantly higher ($p < 0.001$) in the SK&P group than in either non-practicing individuals or in cancer patients in remission. The cancer patients then learned SK&P. After 3–6 months of regular practice, there was a significant increase in the cancer patients' NK cell count. This is particularly encouraging, since cancer survivors have abnormally low levels of NK cells, and NK cells are believed to be important in the body's defense against new and recurring cancers.

Effect on Antioxidant Enzymes

The body is repeatedly exposed to environmental pollutants, and its cells continuously produce normal metabolic by-products. Both of these factors can result in the formation of free radicals. These react

Increased Glutathione (antioxidant self-defense)



with oxygen and cause oxidant damage, contributing to many diseases, including cancer and such cardiovascular diseases as heart disease and stroke.

To counteract these free radicals, the human body has a defense system in the form of antioxidant enzymes. A study was conducted

to assess the effect of SK&P on antioxidant enzymes. Levels of three major antioxidant enzymes—superoxide dismutase (SOD), catalase, and glutathione—were all found to be significantly higher in SK&P practitioners than in the matched control group. These data suggest that people who practice SK&P have an improved antioxidant status and an enhanced defense against oxidant damage.

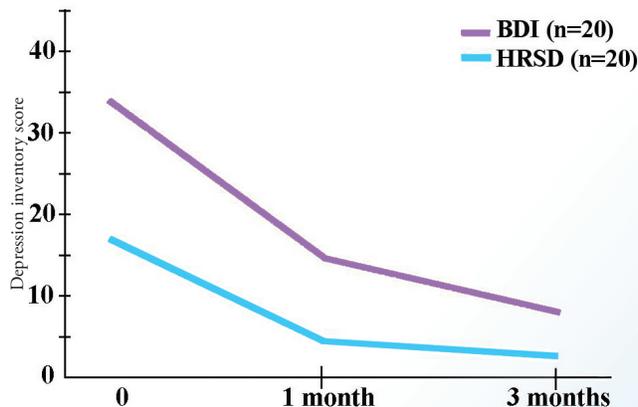
Effect on Blood Cholesterol

Psychosocial stress is a major contributor to hypertension and coronary heart disease (CHD). In CHD, deposits of LDL cholesterol, fat, and other substances on the arterial walls slow or block the flow of blood, resulting in heart malfunction. A study was conducted to assess the cholesterol levels of individuals before they learned SK&P, as well as after 7 and 45 days of regular practice. Significant *drops* in total cholesterol and LDL (harmful) cholesterol, as well as *increases* in HDL (beneficial) cholesterol were observed. These findings suggest that SK&P improves the blood cholesterol profile, and that regular practice may therefore prove to be an effective tool in preventing and arresting hypertension and CHD.

Effect on Depression

SK&P has been shown to have a 68%–73% success rate in the treatment of depression, regardless of severity. Relief from depression, determined by psychiatric evaluation and standard psychiatric measures (Beck Depression Inventory, Hamilton Rating Scale for Depression, and others), was experienced within three weeks. At the three-month follow-ups, patients remained stable and in remission. Published studies further suggest that SK&P normalises patients' brain-wave patterns, increases serum prolactin (a "well-being" hormone), and is as effective as standard anti-depressant drug regimens. Yet

Relief from depression, as indicated by standard psychiatric measures.



it is safe, free of unwanted side-effects, cost-effective, and self-empowering.

Conclusions

The subjective reports of increased health, vitality, well-being, and peace of mind by thousands of SK&P practitioners are consistent with research findings to date, which suggest an overall strengthening of the mind/body system. EEG, blood cortisol, and lactate levels reflect a state of relaxation, yet alertness. Significant increases in NK cells and antioxidant enzymes suggest that regular practice may help prevent many serious diseases. Decreases in cholesterol may prevent cardiac disease, and depression is quickly alleviated in a high percentage of individuals. Thus, even though further studies are needed, these findings point to the powerful health restoration and promotion effects of these time-honored practices.

Selected References

Sharma, H., Sen, S., Singh, N.K. Bhardwaj, V. Kochupillai, N. Singh (2003). Sudarshan Kriya practitioners exhibit better antioxidant status and lower blood lactate levels. *Biological Psychology*, 63:281-291.

Bhatia, M., Kumar, A., Kumar, N., Pandey, R.M., and Kochupillai, V. (2003). Electrophysiologic evaluation of Sudarshan Kriya: an EEG, BAER, and P300 study. *Indian J. Physiol. Pharmacol*, 47, 157-163.

Janakiramaiah, N., Gangadhar, B.N., Naga Venkatesha Murthy, P.J., Harish, M.G., Subbakrishna, D.K., Vedamurthachar A. (2000). Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: a randomized comparison with Electroconvulsive therapy (ECT) and Imipramine. *Journal of Affective Disorders*, 57(1-3):255-9.

Naga Venkatesha Murthy, P.J., Janakiramaiah, N., Gangadhar, B.N., Subbakrishna, D.K. (1998). P300 amplitude and antidepressant response to Sudarshan Kriya Yoga (SKY). *Journal of Affective Disorders*, 50(1):45-8.

Naga Venkatesha Murthy, P.J., Gangadhar, B.N., Janakiramaiah, N., Subbakrishna, D.K. (1997). Normalization of P300 Amplitude following Treatment in Dysthymia. *Biological Psychiatry*, 42, 740-743.

Find more studies and information at www.aolresearch.org

Independent research has shown that Sudarshan Kriya and accompanying practices significantly:

- Reduce levels of stress (reduces cortisol—the “stress” hormone)
- Benefit the immune system
- Reduce cholesterol
- Relieve anxiety & depression (mild, moderate & severe)
- Enhance brain function (increases mental focus, calmness & recovery from stressful stimuli)
- Enhance health, well-being & peace of mind



The Art of Living Foundation, founded by Sri Sri Ravi Shankar, is a non-profit educational and humanitarian organisation, and a Non-Governmental Organization of the United Nations in special consultative status with the UN’s Economic and Social Council.

The Art of Living Foundation’s International Research and Health Promotion Center (IRHPC) welcomes scholarly research on its programs from all interested parties. If you would like to conduct or collaborate on research, or would like more information about our research and health-promotion programs, please contact the IRHPC, at

European Centre: research@aoluniversity.org
North American Centre: research@artofliving.org

Or visit www.aolresearch.org



Art of Living Foundation • Bad Antogast 1 •
77728 - Oppenau • Germany • www.artofliving.org