

## Study of Lipid Profile and Pulmonary Functions in Subjects Participated in Sudarshan Kriya Yoga

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**Abstract:** We intended to study the effect of Sudarshan Kriya Yoga, a novel breathing technique conceived by the world renowned spiritual leader and founder of The Art of Living Foundation Sri Sri Ravishankar. Millions of followers all over the world are practicing and reporting positive well being and better health. To see the effect of Sudarshan Kriya Yoga on Lipid Profile, Pulmonary Function and Hemoglobin concentration, we conducted a workshop of 8 days consisting of 150 participants. Out of which 55 were included in the study group. Our results show that after practicing Sudarshan Kriya, there is decrease in Total Cholesterol, LDL-Cholesterol along with significant increase in HDL-Cholesterol. There are significant changes in Pulmonary Function, but statistically non-significant changes in Hematological parameters. From the observation Sudarshan Kriya Yoga may play vital role in reducing Total Cholesterol ( $P < 0.05$ ), LDL-Cholesterol ( $P < 0.001$ ) and significantly increasing HDL-Cholesterol ( $P < 0.001$ ). Spirometric Pulmonary Function Tests studied were Forced Vital Capacity, Forced Expiratory Volume in first second, Peak Expiratory Flow Rate and Maximum Voluntary Ventilation. The results showed improvement in all Pulmonary Function parameters in all subjects as compared to before practicing Sudarshan Kriya Yoga. Thus Sudarshan Kriya Yoga may have therapeutic implication in the adjunctive (non pharmacological) management of cardiovascular diseases and respiratory diseases. The present study confirmed the positive effect of Sudarshan Kriya Yoga on Lipid Profile and Pulmonary Function over period of 8 days.

Key words: Sudarshan Kriya Yoga (SKY), Pulmonary Function Tests and Lipid Profile

### Introduction

Yoga, an ancient Indian science has been practiced as a healthy way of life. Recently, yoga has been adopted as an approach to health within alternative medicine [1]. Modern man is the victim of stress and stress related disorders which threaten to disrupt life totally [2]. Yogic life style, yogic attitudes and various yogic practices help man to strengthen his body and mind. Living a happy and healthy life on all planes is possible through the unified practice of Sudarshan Kriya Yoga (SKY) along with asana and pranayama when performed consciously and with awareness [2]. Yoga emphasizes on controlled breathing (pranayama), body posture (asana), relaxation of mind (meditation) keeps a person energetic & healthy for maintaining health and fitness and for treating diseases [2-3]. SKY is unique breathing process advocated by The Art of Living Foundation, Bangalore, India. The Foundation is one of the established yoga school of international renown. SKY is said to heal and purify from within and is a natural and noninvasive technique [3]. SKY has a sound scientific basis and is an ideal tool for improving the health. The practice of yoga has beneficial effect on biochemical and physiological functions [2]. However to put yoga on a firm scientific pedestal and popularize it among the general public, we

planned to undertake a study of the effect of SKY on Lipid Profile which includes Total Cholesterol (TC), LDL-Cholesterol (LDL-C), VLDL-Cholesterol (VLDL-C), HDL-Cholesterol (HDL-C) and Triglycerides (TG) and on Pulmonary Function Tests in subjects undergoing SKY workshop (pre and post) at Krishna Institute of Medical Sciences University, (KIMSU) Karad.

### Materials and Methods

In our study 55 healthy subjects including medical students, teaching and non-teaching staff of either gender (age group 18-50 years) at Krishna Institute of Medical Sciences University, Karad were recruited. Each subject was interviewed using a modified ATS78 questionnaire [4]. The subjects were trained to perform SKY in three rounds by slow breathing (20 times), medium breathing (40 times) and fast breathing (40 times) in 30-40 minutes. Blood was collected from the each subject before and after one week practicing SKY and assessed for the Lipid Profile parameters such as TC, LDL-C, VLDL-C, HDL-C and TG by using kit methods [5-6] and Hematological parameters on cell counter [7]. General physical and systemic examination was carried out. Anthropometric measurements (height in cm, weight in kg) were also taken. Pulmonary Function of these subjects were measured by computerized "MEDISPIROR" instrument [8]. Before recording the Pulmonary Function Tests, subjects were shown demonstration of the tests. Consequently minimum three readings were recorded of each test for every subject and the best of the three was selected for having reproducibility and validity of the recorded test. Pulmonary Function Tests studied were Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV<sub>1</sub>), Peak Expiratory Flow Rate (PEFR) and Maximum Voluntary Ventilation (MVV). The values of all tests were taken as % predicted as per age, sex and height of each subject according to standard equation [8].

*Exclusion criteria* : History of active sports training, previous experience of yoga, history of major medical illness such as tuberculosis, hypertension, diabetes mellitus, bronchial asthma, history of major surgery in the recent past, smoking, alcohol consumption and non-vegetarian diet.

*Analysis of Data*: The data was analyzed by using student's paired 't' test and P values of less than 0.05 were accepted as significant difference between the compared values.

### Results

Table 1. Depicts the Mean  $\pm$  SD values of serum TC, LDL-C, VLDL, HDL-C, and TG. The TC (P<0.05) and LDL-C (P<0.001) was significantly decreased, where as HDL-C (P< 0.001) was significantly increased after SKY training when compared to before SKY training.

Table 1. Mean values of Lipid Profile in subjects participated before and after Sudarsha Kriya Yoga (SKY) at KIMSU, Karad.

Biochemical Parameters	Before SKY (N = 55)	After SKY (N = 55)
Total Cholesterol (TC) (mg/dl)	170.6 ± 38.93 (104 - 254)	163.4 ± 26.94 * (110 -225)
Serum Triglyceride (TG) (mg/dl)	72.29 ± 27.26 (37 - 141)	82.07 ± 34.86 · (45 - 205)
Very Low Density Lipoproteins (VLDL) (mg/dl)	14.36 ± 5.38 (07 - 28)	17.54 ± 11.03 * (09 - 80)
Low density Lipoproteins (LDL) (mg/dl)	108.70 ± 37.27 (51 - 190)	93.61 ± 25.49 *** (42 - 149)
High density Lipoproteins (HDL) (mg/dl)	47 ± 9.88 (30 - 75)	53.56 ± 9.66 *** (35 -70)

\*\*\* P < 0.001, \* P < 0.05, · Non significant as compared to before SKY

Fig 1. Shows the Percentage change (%) of Lipid Profile in subjects participated before and after SKY at KIMSU, Karad. Here LDL-C was decreased by 13.88%, HDL-C increased by 20% after SKY training as compared to before SKY training.

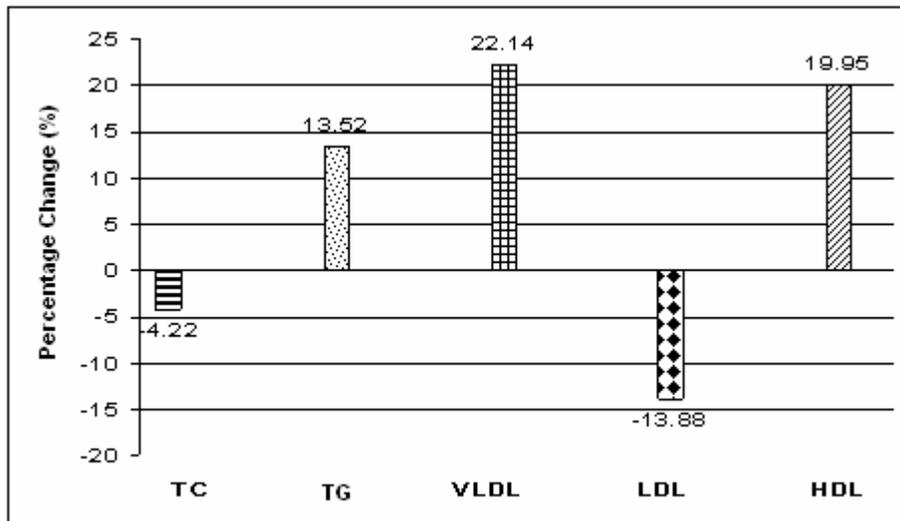


Fig1. Percentage change (%) of mean values of Lipid Profile in subjects participated before and after SKY at KIMSU, Karad.

Table 2. Shows the Pulmonary Function Tests in the subjects participated before and after SKY at KIMSU, Karad. The results showed significant increase in all Pulmonary Function parameters such as FVC, FEV<sub>1</sub>, PEFR and MVV after SKY training as compared to before SKY training.

Table 2. Mean values of Pulmonary Function Tests in the subjects participated before and after SKY at KIMSU, Karad.

Pulmonary Function Tests	Before SKY (% of predicted) (n=55)	After SKY (% of predicted) (n=55)
Forced Vital Capacity (FVC)	90.38±10.34	98.54±11.22**
Forced Expiratory Volume in first second (FEV <sub>1</sub> )	101.71±11.37	107.71±11.80**
Peak Expiratory Flow Rate (PEFR)	74.0±19.59	89.92±15.98**
Maximum Voluntary Ventilation (MVV)	75.94±12.04	86.87±13.54**

\*\* P < 0.01 statistically significant as compared to before SKY

Fig 2 Shows Percentage change (%) of Pulmonary Function Tests in the subjects participated before and after SKY at KIMSU, Karad. There are increased in FVC (9%), FEV<sub>1</sub> (5.89 %), PEFR (21.51%) and MVV (14.39 %) after SKY training as compared to before SKY training.

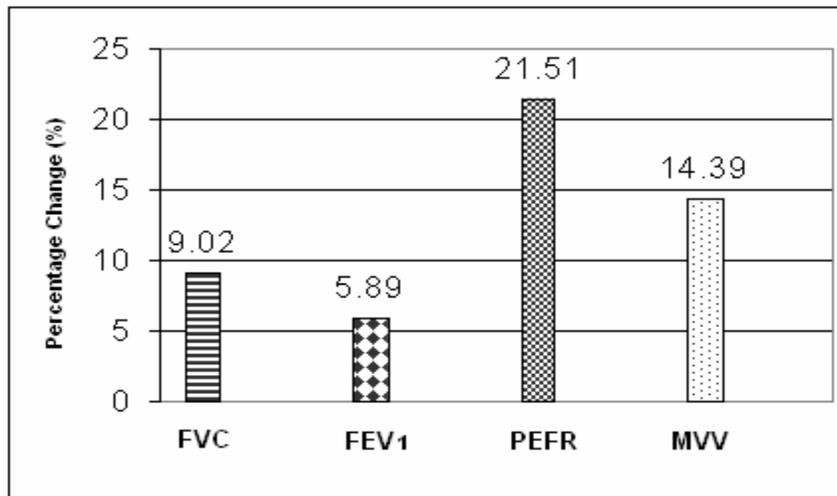


Fig 2. Percentage change (%) of mean values of Pulmonary Function Tests in subjects participated before and after SKY at KIMSU, Karad.

Table 3. Shows Hematological parameters in subjects participated before and after SKY at KIMSU, Karad. There are non-significant changes in all parameters as compared to before SKY training.

Table 3. Mean values of Hematological parameters in subjects participated before and after SKY at KIMSU, Karad.

Hematological parameters	Before SKY (N = 55)	After SKY (N = 55)
Hemoglobin (Hb) (gm/dl)	13.04 ± 1.78 (9 – 17)	12.81 ± 1.78 (8.4 – 17.2)
Total Leucocytes (TLC) ( /cmm)	6810 ± 1633 (4100 – 10500)	7156 ± 1571 (4100-10700)
Platelet count (PLC) ( /cmm)	2.639 ± 58.34 (1.62 – 4.61)	2.425 ± 50.11 (2.76 – 3.80)
Packed cell volume (PCV) (%)	38.64 ± 5.50 (26.4 – 52.1)	37.53 ± 4.42 (28.4 – 45.6)
Red Blood Cell Count (RBC) ( 10 <sup>6</sup> / cmm)	4.85 ± 0.51 (3.72 – 6.1)	4.68 ± 0.44 (3.85 – 5.8)

· Non significant as compared to before SKY

### Discussion

The ancient Indian yoga system emphasizes on controlled breathing (pranayama), body postures (asanas), relaxation of mind (Meditation) [2-3]. SKY is a unique breathing process not practiced as a single technique but is integrated with asanas, pranayama, meditation and attitude training. This type of yoga is said to heal and purify within, is a natural and non invasive stress relieving technique [3]. SKY or “Proper Vision by Purifying Action” is an advanced form of cyclical breathing at variant rate, slow, medium and fast [9]. It is preceded by Ujjayi pranayama (long & deep breath with constriction at the base of throat) and Bhastrika (fast and forceful breaths through nose along with arm movements) [9]. Table 1. shows decrease in TC, significant decrease in LDL-C along with significantly increase in HDL-C after 8 days of SKY training. The review showed that yoga had beneficial effect on Body Weight, Blood Pressure, Blood Glucose level and Cholesterol level [10]. The practice of yoga was associated with significant decrease in cholesterol among subjects with cardiovascular diseases, atherosclerosis, angina, hypertension and Type 2 Diabetes at different duration of yoga [10-16]. Because of ability of HDL to retard the oxidation of LDL, it can prevent the pro-inflammatory effects of oxidized LDL (ox-LDL) on the endothelium. Thus HDL can prevent ox-LDL induced production of monocyte chemotactic protein-1, intracellular adhesion molecule-1 and vascular cell adhesion molecule. This retards monocyte endothelium interaction, the first stage in the inflammatory process in atherosclerosis [17]. Cardio protective effect of HDL-C is mainly exerted by facilitating the reverse cholesterol and other

adjuvant effects such as anti-inflammatory, antioxidants, anticoagulant and fibrinolysis. Recently published data studies indicate a regulatory role for HDL-C in endothelium function. The binding of HDL-C to scavenger receptors leads to

the activation of endothelial nitric oxide synthase and therefore enhances vasorelaxation [18]. Results of our study found significant improvement in Lipid Profile parameters after SKY. The improvement in the Lipid Profile parameters after yoga could be due to increased hepatic lipase and lipoprotein lipase at cellular level, which affects the metabolism of lipoprotein and thus increase uptake of triglycerides by adipose tissues [19]. Better ability to overcome stress can be cited as possible mechanism for improvement in Lipid Profile [20]. Studies on the ancient practice of Yoga have demonstrated an improvement in respiratory function. Yoga consists of a number of different practices, the most common of which are the pranayama, the coordination of controlled ventilation and the asanas or stretching exercises. Pranayama requires breath holding which may result in increased parasympathetic control of respiratory control centers [21]. Long duration training of SKY improves many body functions. Lung Function is also improved. Short duration (8 days) SKY training is quite beneficial in improving one's Lung Ventilatory Function. Our results are consistent with the earlier studies [22-26]. They had noticed increase in values of Pulmonary Function Tests. However in our study all the Spirometric Lung Function Tests viz. FVC, FEV<sub>1</sub>, PEFR and MVV were significantly increased after 8 days SKY training [Table 2]. JS Bhuvaneshwaran (2005) study confirms the positive effects of SKY on certain cardiorespiratory parameters. For long SKY, there is significant effect on Tidal Volume and oxygen saturation ( $P < 0.05$ ) [27]. Although clear cut evidence is lacking, the mechanisms by which changes in respiratory functions occur are greater relaxation of respiratory muscles induced by supraspinal mechanisms which increase expiratory reserve volume contributing to a rise in vital capacity [28]. Lung inflation to near total lung capacity is a major physiological stimulus for release of surfactant and prostaglandin into alveolar spaces. This causes increase in lung compliance and decrease in bronchiolar smooth muscle tone [28]. Lung inflation to near total lung capacity as induced by relaxation during meditation may thus lead to a better vital capacity. The increased breath holding time caused by greater control of respiratory musculature and the ability to consciously override the normal physiological stimuli of respiratory centers has been reported in the study on those doing yoga [28]. By consistently performing a variety of asanas, muscles of the thoracic cavity are constantly being recruited. This recruitment may lead to greater musculature and thereby result in improved FVC [21]. Comparing males and females showed significant differences in FVC. This result suggests that normal males on an average have a larger muscular thoracic cavity enabling them to force more air out of the lungs resulting in higher volumes of FVC. Perhaps a similar mechanism comes in to play here [21].

Table 3. Shows non-significant changes in all Hematological parameters. Yoga has given patients the hope to reduce medication besides slowing the progression of the disease [19]. However further extensive and long term studies need to be done to prove these findings and understand the basic mechanism involved. Thus combined

practice of SKY seems to be beneficial on Lipid Profile parameters and improve respiratory efficiency in normal healthy individuals.

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