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## **Effect of Sudarshan Kriya on Pulmonary Function and Performance of Rowers – A Literature Review**

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### **Abstract**

A research was undertaken with a view to examine effect of Sudarshan Kriya on Pulmonary function and performance of rowers. Pulmonary function means lungs function in human body. The primary goal of the PFT is how well person's lungs are working. Performance of the sportsperson significantly depends upon lungs function capacity. The criterion for functioning includes how much air lungs can hold, how fast air can be moved in and out of lungs, how well lungs put oxygen into and remove carbon dioxide. Sports events like 2000 metres rowing, 10KM marathon requires a good stamina and endurance as they have greater duration. Hence pulmonary function or lung capacity function is vital element for the performance of 2000 meters rowers. Experimental approach was adopted. Before the full-fledged study was undertaken a literature review was carried. This article presents the same along with the gap.

**Keywords:** Sudarshan Kriya, Rowing, Literature Review

### **Introduction**

Literature on Sudarshan Kriya, Rowing and pulmonary functioning is widely available. However, the aim of this literature review is to collate these three to consider the application of Sudarshan Kriya for

improving pulmonary functioning and performance of rowers. The literature review therefore begins with a stand-alone assessment of the items and then synthesizes the items into collective observations and finally identifies the research gap leading to this study. Specific objectives were formulated and self-evolved guidelines were set to facilitate the literature review. The literature review was carried with the following objectives –

- a) To review literature on Sudarshan Kriya
- b) To review literature on pulmonary function
- c) To review literature on effect of Yoga on sportspersons

### **Review of Literature –**

Literature on Sudarashan Kriya was reviewed by way of a tabular analysis. Details are not given for want of space.

Volga Hovsepian, Sayyed Mohammad Marandi, Roya Kelishadi, Arash Zahed (2013) Objective of the study was aimed to survey the effect of yoga and aerobic trainings on pulmonary and physical fitness factors of healthy female university students. Methodology of the study is quasi- experimental study included 60 healthy female students who were randomly assigned into two groups; exercising yoga and aerobics twice a week for three months. Respiratory rate (RR) along with Pulmonary Function Tests such as pulmonary capacities (PEF, PIF, FEV1, FVC), and physical fitness factors including flexibility, balance, and maximal aerobic capacity (vo2max), were measured at baseline and after applying trainings. They used spirometry, sit and Reach, one leg balance stance, and Bruce treadmill protocols for evaluating these variables. The data were analyzed using student (T – test) at  $P < 0.05$  significance level.

Result of study was participants had a mean  $\pm$ SD age of  $19.02 \pm 2.19$  years, height of  $160.48 \pm 5.34$  cm and weight of  $56.7 \pm 10.7$ kg with no significant differences between the two groups. After training, in the yoga group; RR decreased, pulmonary and all physical fitness parameters except vo2max increased significantly ( $P < 0.05$ ). In the aerobic group; PEF and PIF increased significantly. There were no changes in RR, FEV1, FVC, however all physical fitness parameters improved significantly ( $P < 0.05$ ). Conclusion of study is their findings suggest that yoga training can lead to significant improvement in

most variables except vo2max. Therefore, regular practice of yoga seems to improve health related aspects of physical fitness and may enhance wellness.

P. Shyam Karthik, M. Chandrasekhar, Kondam Ambareesha and C. Nikhil (2014) Pranayama improved lung functions in numerous studies. Yoga involves isometric contraction and improves skeletal muscle strength. Yoga training improves the strength of expiratory as well as inspiratory muscles. Aim of the study was to find the effect of pranayama on pulmonary functions in medical students.

This study was conducted on 50 students doing 1<sup>st</sup> year M.B.B.S. Consent form has been taken from them. They have been given yoga training 30 min daily for 2 month under the guidance of a trained yoga instructor. Vital capacity (VC), Tidal volume (TV), Expiratory Reserve volume (ERV), Breath holding time (BHT), 40 mm endurance, Peak expiratory flow rate (PEFR) were measured before & after yoga training.

Result of the study was VC has increased from  $2972 \pm 213.151$  to  $3372 \pm 528.7722$ . TV has increased from  $496 \pm 84.06347$  to  $588 \pm 150.8863$ . ERV also shows increase in values from  $888 \pm 183.303$  to  $1096 \pm 386.7385$ . BHT also shows increase in values from  $33 \pm 5.773503$  to  $58.6 \pm 12.78019$ . 40 mm endurance also shows increase in values from  $30.8 \pm 5.139715$  to  $53.52 \pm 15.68736$ . PEFR also shows increase in value from  $388.8 \pm 15.36229$  to  $425.2 \pm 38.74274$

Conclusion of the study is there is a statistically significant increase in all the above mentioned pulmonary functions following yoga training. Yoga practice can be advocated to improve pulmonary functions in healthy individuals.

Madanmohan, Udupa K, Bhavnani A.B, Vijayalakshmi P, Surendiran A (2005) Objective of this study was to undertake effect of short term (Three week) training in savitri ( slow breathing) and bhastrika ( fast breathing) pranayamas on respiratory pressures and endurance, reaction time, blood pressure, heart rate, rate pressure product and double (Cardiovascular) product. Thirty student volunteers were divided into two groups of fifteen each. Group 1 was given training in savitri pranayam that involves slow, rhythmic, and deep breathing. Group 2 was given training in bhastrika pranayam, which is bellows type rapid and deep breathing.

Parameters were measured before and after three week training period. Savitri pranayam produced a significant increase in respiratory pressures and respiratory endurance. In both the groups, there was an appreciable but statistically insignificant shortening of reaction time. Heart rate, rate pressure product decreased in savitri pranayam group but increased significantly in bhastrika group. All values of the two groups were comparable before training period.

In savitri pranayam group there was significant  $p < 0.05$  increase in MEP (Maximum expiratory pressure), MIP (Maximum inspiratory pressure) and respiratory endurance after three week of the training period. In bhastrika pranayam group, there was highly significant  $p < 0.01$  increase in respiratory endurance and an insignificant increase in MEP and MIP. BHT (Breath holding time) increased significantly  $p < 0.05$  in bhastrika pranayam group and insignificantly in savitri pranayam group. Although there was a decrease in VRT (Visual reaction time) and ART (Auditory reaction time) in both the groups, this decrease was statistically insignificant. Following three weeks of training, HR (Heart rate), RPP (Rate pressure product) and Do P (Double product) decreased in savitri pranayam group and increased in bhastrika pranayam group and the difference between the two groups was statistically significant  $p < 0.05$  when compared by students unpaired t-test. There was also a significant decrease  $p < 0.05$  in diastolic pressure (DP) in savitri pranayam group following three weeks of training. It is concluded that different types of pranayams produce different physiological responses in normal young volunteers.

Dr Raghav Ashtekar (2015) investigated effect of Suryanamskar, Breathing Exercises and Omkar Chanting on Swimming Performance of Swimmers aged 8 to 16 years. The boy swimmer student (N=120) were randomly selected by researcher for the present study. These subjects were divided into three groups, two experimental groups and one control group, each consisting of 40 students. The entire study or training program was conducted in three phases as Pre-test, Suryanamaskar, breathing exercises and Omkar Chanting training program of 12 weeks and Post-test. Mean, Standard Deviation and One-Way ANOVA was used for the results.

Researcher after stating major findings concluded that 12 weeks of training program in Suryanamaskar, breathing exercises and Omkar Chanting had significant effect on 50-meter freestyle swimming performance of 8 to 16 years old boy's swimmers from Pune city except for age group under 10 years.

Vinayak P. Doijad, Prathamesh Kamble, Anil D. Surdi (2013) have stated that Yoga is considered to be a very good exercise for maintaining proper health. It produces consistent physiological changes and have sound scientific basis. It is claimed that yoga practices improve various cardio respiratory fitness parameters. Aim of study was to find the effect of short term Yoga practice on aerobic capacity (VO<sub>2</sub> max.) Objective of the study was to measure aerobic capacity (VO<sub>2</sub> max.) Before and after Yoga practice. Material and Methods of the present study was conducted on 60 M.B.B.S. students (40 males and 20 females) within the age group of 18-20 years. VO<sub>2</sub> max was measured using bicycle Ergometer in their 'Exercise and Sports Physiology' laboratory. It was recorded at start of study (baseline) and then after 12 weeks of yoga therapy. Results of the study were both the genders VO<sub>2</sub> max was found to be increased after yoga therapy for 12 weeks. Present study concludes that yoga practice can be used to perk up cardio respiratory fitness.

R. Ahilan and R. Senthil Nathan (2012) carried a study to find out the effect of Asana and Pranayama training on physiological variables. To achieve this purpose, thirty boys were selected randomly as subjects. They were assigned randomly into two experimental groups. Group I underwent Asana training and group II underwent Panayama training group of fifteen each. All the subjects of two groups were tested on selected dependent variable such as VO<sub>2</sub>max and resting pulse rate before and after the treatment. The data pertaining to the variables in this study were examined by using dependent 't' and analysis of covariance (ANCOVA). Two experimental groups' namely, Asana and Pranayama training groups achieved significant improvement on VO<sub>2</sub>max and resting pulse rate. In view of improvement in VO<sub>2</sub>max and resting pulse rate was concerned, the Pranayama training was best training when compared to Asanas training.

Shivesh Prakash, Sushant Meshram, Ujjwal Ramtekkar (2007) researched cross sectional observation to determine if yoga and athletic activity running are associated with better lung functions as compared to subjects with sedentary lifestyles and how does athletes and yogis differ in lung function. Spirometric parameters were assessed in randomly selected 60 healthy male, non-smoking, non-obese subjects, athletes, yogis and sedentary workers. The groups differed significantly in FEV<sub>1</sub> and PEF<sub>R</sub>. The highest mean FEV<sub>1</sub> and PEF<sub>R</sub> were observed in yogis. Both yogis and athletes had significantly better FEV<sub>1</sub> as compared to sedentary workers. Yogis also had significantly better PEF<sub>R</sub> as compared to sedentary

workers and athletes. Yogis and athletes had similar lung functions except for better PEFr amongst yogis.

The groups differed significantly in FEV<sub>1</sub> (P=0.047) and PEFr (p=0.022). The highest mean FEV<sub>1</sub> (96.25%) and PEFr (116.77%) was observed in yogis. Lowest FEV<sub>1</sub> and PEFr values were observed amongst sedentary workers and athletes respectively. Comparison of athletes with sedentary workers revealed significantly higher FEV<sub>1</sub> (P=0.038) and FEV<sub>1</sub>/FVC (P=0.02) parameters amongst the athletes. Comparison of yogis with sedentary workers revealed significantly higher FEV<sub>1</sub> (P=0.036) and PEFr (P=0.037) amongst yogis. There was no significant difference in the other parameters measured. Lung functions of yogis and athletes were similar except for PEFr which was significantly higher amongst yogis (P=0.019). Involvement in daily physical activity or sport preferably yoga can help in achieving better pulmonary function.

The result of the present study showed that those performing yoga regularly had higher lung function parameters as compared to athletes and those with sedentary life styles. Significantly higher values were observed for FEV<sub>1</sub> and PEFr. Clinical significance of such differences in pulmonary function needs to be determined, however the significant differences observed in the present study guide us in selecting appropriate exercise for improving pulmonary function.

Rashmi Vyas, Nirupama Dikshit (2002) studied 150 human volunteers of either sex divided into three groups- non meditators, short term meditators (meditation for 6 months to 5 years) or long-term meditators ( meditation for more than five years). The non meditators were a mixed group of students and staff B. J. Medical College and Civil Hospital, Ahmedabad who had never done any kind of meditation. The meditators were practicing Raja Yoga Meditation for 1 hour every morning (7.30 A.M - 8.30 A.M) at the local Brahmakumari Centre, Ahmedabad. In Raja Yoga Meditation the individual uses visual or auditory images for concentration which helps one to proceed to meditation. Details of age, sex, smoking, alcohol, physical exercise undertaken if any, dietary habits were taken before study started.

Blood pressure was recorded using a sphygmomanometer. ECG was recorded by an ECG machine (108 Y, BPL) using standard chest and limb leads. Heart rate was calculated from the tracings. Each ECG was

reported by a trained physician. In respiratory function, tidal volume, vital capacity, breathe holding and expiratory pressure were assessed. The tests were thoroughly explained and each subject was given three trials. In case of tidal volume the average of three readings was taken and in cases of vital capacity and breath holding the highest reading was taken and in cases of vital capacity and breath holding the highest reading was considered. Tidal volume and vital capacity were measured with Wright Respirometer Mark 8 (Farriers Medical Limited, London). Breath holding was measured on a stopwatch till the breaking point of the held breath. Expiratory pressure was recorded through a manometer by the standard procedure. To assess the lipid profile 5 ml of blood was collected. Serum cholesterol, triglyceride and HDL were estimated by their respective reagent sets from Lab care, Baroda and the readings taken on a RA-50 chemistry analyzer.

Descriptive statistics of mean, standard deviation and percentages were used to display the continuous (age, respiratory function, cardiovascular parameters, lipid profile) and categorical (sex, physical exercise, smoking, drinking and diet) variables of the three groups respectively.

Descriptive statistic of mean, standard deviation and percentages were used to display the continuous (age, respiratory functions, cardiovascular parameters, lipid profile) and categorical (sex, physical exercise, smoking, smoking, drinking and diet) variables of the three groups respectively. One way analysis of variance was applied to find the significance of differences between the three groups. In addition, the groups significantly different at 5% level by ANOVA were subjected to Bonferroni multiple comparison procedure. Categorical independent variables were analysed for association with the three groups using Person's Chi-square test. Tidal volume, vital capacity and breath holding are significantly higher in short and long term meditators as compared to non meditators. Only vital capacity and expiratory pressure are significantly lower in both short and long term meditators as compared to non meditators. Heart rate is significantly lower in long term meditator as compared to non meditator and short term meditators. Systolic blood pressure shows no significant difference between the three groups. Electrocardiogram showed no particular pattern or significant changes except for changes in heart rate. Cholesterol is significantly lower in both short and long term meditators as compared to non meditators. Through triglyceride showed a significant P value with ANOVA, further analysis with Bonferroni test showed no significant difference between the three groups. There was no significant difference in HDL values between the three groups.

**Key observations and research gap**

A good number of studies have found a positive impact of Sudarshan Kriya Yoga on stress and anxiety. Mental balance, calmness and composure are important attributes of a successful rower.

The review shows a vast variety of application of Sudarshan Kriya Yoga ranging from treatment of stress and anxiety to diabetes and heart problems. This shows the utility of the SKY to address a number of medical and health issues – both physical and mental.

Another clear observation is the vast number of studies overwhelmingly supporting a positive impact of SKY on pulmonary function.

Interestingly studies on effect of SKY on sports are relatively few. In fact there is no study directly studying the impact of SKY on pulmonary function and performance of rowers. The researcher wants to check whether regular practice of Sudarshan Kriya effects positively on Pulmonary functions of rowers and with the help of this they can improve their performance. Hence the selected subject is “Effect of Sudarshan Kriya on pulmonary functions and performance of Rowers”.



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She has represented Maharashtra State in various national tournaments in Rowing & Gymnastics and won various medals. In 2007 she was **awarded Shri Shiva Chhatrapati Award** (Highest Award for the Sport from the State) for **Rowing** from the Maharashtra Government. She has been awarded District sports award in 2006.

She was associated with Art of Living organization since last 15 years as her father is full time teacher in Art of Living, she has completed the Basic Course (Happiness Program) of Art of Living. She has deep faith in Hon. Guruji Shri Shri Ravi Shankarji and follows Sudarshan Kriya on regular basis. While her professional carrier in rowing, she was practicing Sudarshan Kriya and found remarkable increase in her breathing stamina and pulmonary function.

She has keen interest in pranayama techniques, meditations and finding its impact of performances of sports persons. She has won Gold Medal in the Nationals for Rowing in 2002, Silver Medal in 2001 and Bronze Medals in 2003, 2004, 2005 & 2006. She has won Bronze medal in Rowing in National Games held at Guwahati in 2007. She has won medals continuous three years in AIU (All India University) for Rowing. She was state champion for continuous eight years for rowing.

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