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Effect of Yoga on Respiratory Endurance Test in Medical Students

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Abstract

Introduction: Yogic practices can be considered to be a very good exercise for maintaining proper health and also has a profound effect on the lung functions of an individual. They are also used as psycho-physiological stimuli to increase the physiological functions and human performance. The present work is undertaken as there was no reported data on comparison of pranayama & suryanamaskar practitioners in various pulmonary endurance functions. **Materials & Method:** The present study was conducted at MNR Medical College & Hospital, Sangareddy. The Institute Ethical Committee approved the study protocol. Informed consent was taken from all the subjects. The study was conducted with 80 subjects (aged between 18 to 20 years), under the supervision of a qualified yoga trainer. Inclusion Criteria: Medical students of age between 18-20 years, Only volunteers who are interested in practicing Yoga, Non alcoholic & non smokers. Exclusion criteria: Previous experience of yoga training and physically challenged persons. **Results:** The MVV, 40 mm endurance and chest expansion were significantly increased ($p<0.005$) in the pranayama group (Group-II) and suryanamaskar group (Group-III). But the RR was significantly decreased ($p<0.005$) in pranayama (Group-II), suryanamaskar (Group-III) and combined group (Group-IV) than control group (Group-I), ($p<0.005$). **Conclusion:** The regular practice of pranayama and Suryanamaskar practice induces more beneficial effects than physical exercise which mostly affects skeletal muscles. To meet the modern life style which is full of challenges and stress, an all-round personality development has become mediatory for the student, this aspect of relaxation and detachment is lacking in our education system and it is this new dimension (yoga) that needs to be added to the curriculum.

Keyword: *pranayama, suryanamaskar(SN), respiratory endurance, peak expiratory flow rate, vital capacity*

Introduction

Yoga is an ancient science of technique exercise associated with a set of principles and practices. Yogic lifestyle modification leads to remarkable improvement in the subjective wellbeing and can make an appreciable contribution to primary prevention and management of lifestyle diseases in day-to-days life[1]. Suryanamaskar and pranayama have been shown to reduce the resting respiratory rate; increase vital capacity, Timed Vital Capacity, Maximal Voluntary Ventilation, Breath Holding Time, Maximal Inspiratory Pressure and Maximal Expiratory Pressure[2]. Yogic exercises are popular all over the world in these days which increase longevity and have therapeutic and rehabilitative actions[3]. Asanas involved in surya namaska, a component in the yogic system tunes the range of flexibility of the practitioners. Hence selective package of yogic exercises (pranayama and suryanamaskar) would prove a positive impact among the student population in executing the skills for the better performance in their education as wholesome shaping of human body and mind[4]. Govindarajulu (2003) observed the effects of Yoga practices on flexibility and cardio respiratory endurance on high an out school girls where he found significant improvement on those selected variables after the training period[5].

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There was enough literature on the effect of pranayama and suryanamaskar on pulmonary functions. In view of this, the present study was designed to evaluate the effects of combined yoga training on respiratory efficiency functions in healthy individuals aged 18 to 24 years.

Aim & Objectives

To investigate the effect of suryanamaskar practice on various respiratory endurance tests i.e. MVV (L/min), chest expansion, RR/Min and 40mm/sec after six months of training programme.

Materials & Method

This study was conducted in the Department of Physiology, MNR Medical College Hospital &hospital, Sangareddy, Telangana. After approval of Institutional Human Ethical Committee, eighty medical students between the age group of 18 to 24 years (20 ± 2 years) of both the sexes were selected. Informed and written consent were taken from all the participants involved in the study. The duration of the study was six months. 80 normal medical students of MBBS were randomly selected and included in our study. The participants were divided into four groups namely; control, pranayama, suryanamaskar and combined group of pranayama and suryanamaskar.

Table 1: Equal distribution of participants into groups for the 6 months duration of the study

S. No	Groups	No. of participants	Duration of training
1	Group-I (before yoga group)	20	-
2	Group- II (Pranayama)	20	6 months
3	Group-III (Suryanamaskar group)	20	6 months
4	Group-IV (Combined group of pranayama & suryanamaskar)	20	6 months

General characteristics (age, body weight, height, and body mass index: BMI) were observed in subjects. All subjects were assigned to learn the whole yoga protocol and were explained in detail by the investigator. On the first day of study, subjects came to the training room and endurance tests were assessed using standard test. These were pre yoga exercise values. After six months of yoga training, the same tests were conducted which were designated as the post yoga values. **Inclusion criteria:** Medical students of age between 18-24 years. Only volunteers who were interested in practicing Yoga. Non alcoholic & non smokers. **Exclusion Criteria:** Previous experience of yoga training. History of major medical illness in the past e.g., Tuberculosis, Hypertension, Diabetes mellitus, Bronchial asthma etc. History of major surgery in the recent past.

All tests were carried out in the laboratory of the Department of Physiology, MNR Medical College & Hospital, Sangareddy. The laboratory environment was, quiet the temperature was between 33 0C–35 0C and the lighting subdued. The study did not involve intravascular instrumentation at any stage. The participants were explained in detail about the study protocol and written informed consent was obtained from them. The subjects were advised to come at 4 pm completely relaxed with empty bowel and bladder. All subjects who were included in the study (yoga group) were advised to refrain from smoking and alcohol during the entire study period.

All the subjects were asked to practice daily for about one hour. Yoga classes started with a brief prayer. Preparatory practices like breath-body coordination and joint loosening exercises were undertaken for 10 minutes. The duration of the study was six months; the yoga training was performed for 30 min, daily for 5 days a week. This was followed by 30 minutes of either pranayama (Group-II) or suryanamaskar (Group-III) or combined Group (pranayama and suryanamaskar).

At the end of yoga training exercise, attendance was taken and the subjects were motivated to practice regularly. Some of the classes were preceded by talk on diet and lifestyle modification in controlling chronic lifestyle disorders.

Endurance Test

MVV (Maximum Voluntary Ventilation): was measured by asking the subject to breathe as deeply and rapidly as possible for 15 seconds into the computerized spirometer model, RMS 401with the Helios software and the results in L/min were recorded in sec.

40 mm Endurance Test: After a deep expiration, the subjects were asked to inspire to the maximum. A clip was applied to the nose and the subject asked to expire into the mercury manometer up to the level of 40mm and to maintain it as long as possible. The maximum possible maintenance time were recorded in sec.

Chest Wall Expansion: The degree of expansion of chest was measured by placing an inch tape just below the nipple around the chest with its mark at the middle of the sternum. Instruction was given to the subjects to breath in and out as deep as possible. Readings were taken after 2 or 3 breaths. Measurement of the chest circumference was done at the end of deep inspiration and expiration and values were expressed in centimeters.

Respiratory rate (RR): The right palm was placed over the upper part of abdomen of the subject and the number of respirations in one minute was counted.

Results

Statistical analysis

All the values obtained before and after performing Pranayama, Suryanamaskar and combined pranayama, suryanamaskar yogic exercises were expressed as mean ± SD. The data were analyzed by SPSS 16. 0 version one way ANOVA followed by paired t test (Dennett's test) which was used to compare pre and post training results. P values of less than 0.05 were accepted as significant difference between the compared values. Comparison of respiratory endurance in pranayama, suryanamaskar and combined pranayama and suryanamaskarar procedures

The MVV, 40 mm endurance and chest expansion were significantly increased ($p<0.005$) in the pranayama group (Group-II) and suryanamaskar group (Group-III). But the RR was significantly decreased ($p<0.005$) in pranayama (Group-II), suryanamaskar (Group-III) and combined group (Group-IV) than control group (Group-I), ($p<0.005$).

Table 2: Comparison of respiratory endurance in pranayama, suryanamaskar and combined pranayama and suryanamaskarar procedures.

S.No	Parameters	Before yoga (Group-I) (n=20) (Control)	After Pranayama (Group -II) (n=20)	After Surya namaskar (Group -III) (n=20)	Combined Group- (Group-IV) (n=20)
1	RR/min	18.14 ± 1.57	16.03 ± 1.46*	15.59 ± 0.32*	14.0 ± 1.69*
2	MVV (L/min)	97.01 ± 1.15	107.23 ± 0.91*	110.83 ± 1.45*	110.10 ± 1.67*
3	40mm endurance	25.95 ± 0.57	26.19 ± 1.23*	27.09 ± 0.52*	27.02 ± 1.51*
4	Chest expansion (cm)	2.27 ± 0.57	3.00 ± 0.52*	3.79 ± 0.91*	3.01 ± 1.14*

Values are expressed as mean ± SD; *$p<0.05$ significant, **$p<0.001$ highly significant

Discussion

Pranayama and suryanamaskar practice showed a significant improvement in MVV. These findings concur with the study conducted by **Joshi, et al** in 1992 who reported a statistically significant increase in MVV. The RR was significantly decreased in the post yoga group ($p< 0.05$) than the pre yoga group[6].

Practicing Pranayama and suryanamskara for few weeks, there was a new pattern of breathing which was slower than its basal rhythm leading to decrease in respiratory rate. Yogic practices also improved respiratory muscle endurance. 40mm endurance time, also a showed statistically significant improvement, indicates better respiratory endurance in post yoga group after regular practice of pranayama and suryanamaskar. At the end of 6 weeks Yoga training, chest wall expansion significantly increased ($p < 0.05$) in middle level of the thoracic cage (4th intercostal space) when compared to their pretest values. Combined Pranayama and

suryanamaskar training improved respiratory capacity especially chest wall expansion and lung volumes. This study agrees with previous reports in Indian adolocent children (**Mandanmohan et al., 2003**) supports the benefit of Yoga as an alternative exercise for health and treatment of some common respiratory disorders[7].

Rajesh et al (2004) found a significant improvement in all pulmonary function with a significant decrease in RR could be mainly due to regulated, slow, deep and controlled breathing for prolonged period during pranayama practice leading to increase in the strength and endurance of expiratory as well as inspiratory muscles and contributing to enhanced voluntary control of breathing. As a technique, pranayama can assume rather complex forms of breathing, but the essence of the practice is slow and deep breathing. Such breathing is economical because it reduces dead space ventilation. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs[8].

Bhutkar et al (2008) showed a statistically significant improvement in SBP, DBP, FEV1, PEFR, MVV, lung compliance and airway resistance as compared to baseline in CAD patients after 3months of regular practice of pranayama and asanas[9].

Regular yogic practices strengthen the respiratory muscles; increase the excursions of diaphragm and lungs as well as thoracic compliance. Also yogic practices decrease airway resistance. All these factors contribute to improvement in the various lung function tests after regular practice of SN. Yogic practices also improve respiratory muscle endurance. 40mm endurance test, which also showed statistically significant improvement, indicates better respiratory endurance in both the groups after regular practice of SN. Yogic asanas and pranayama have been shown to reduce the resting respiratory rate and increase vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressures. Regular practice of suryanamaskar together with pranayama enhances the strength and force of contraction of respiratory muscles like diaphragm and upper abdominal muscles resulting in improvement of MVV and PEFR according to **Joshi et al (1992).**

Increase in inspiratory and expiratory pressures suggests that yoga training improves the strength of expiratory and as well as inspiratory muscles. Respiratory muscles are like skeletal muscles. Yogic techniques involve isometric contraction which is known to increase skeletal muscle strength. Breath holding time depends on initial lung volume. Greater lung volume decreases the frequency and amplitude of involuntary contractions of respiratory muscles, thereby lessening the discomfort of breath holding (**Mandanmohan et al., 2003**). During yoga practice, one consistently and consciously over-rides the stimuli to respiratory centers, thus acquiring control over the respiration. This, along with improved cardio-respiratory performance may explain the prolongation of breath holding time in yoga trained subjects.

Hence daily practice of both Suryanamaskar and pranayama could also be part of physical fitness and life style modification program in maintaining better physical and mental health[10].

Conclusion

Pranayama is an ancient yoga technique. The regular practice of Pranayama integrates the mind and the body. It differs from other forms of exercises as it mainly focuses on the sensations in the body. Pranayama thus acts directly on the various functions of the body and affords benefits in a positive way. Our study showed that the pulmonary function test values improved after short term (6 months) pranayama practice. Regular, slow and forceful inspiration and expiration for a longer duration during the pranayama practice, leading to strengthening of the respiratory muscles. Pranayama training causes improvement in the expiratory power and decreases the resistance to the air flow in the lungs. Pranayama training causes an increase in the voluntary breath holding time. This may be due to acclimatization of the chemoreceptors to hypercapnoea. Pranayama is a type of yogic breathing exercise. This resultant effect of pranayama can be used as lung strengthening tool to treat many lung diseases like asthama, allergic bronchitis, post pneumonia recoveries, tuberculosis and many occupational diseases.

Ethical Clearance- Institutional Ethics Committee (IEC) approval was taken prior to the study.

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Conflict of Interest - None.

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