

EFFECT OF SAVITRI PRANAYAMA PRACTICE ON RESPIRATORY PARAMETERS IN HEALTHY INDIVIDUALS

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ABSTRACT

Background: Yoga makes the mind calm & relaxed, strengthens & tunes the body, brings them into harmony with each other. Pranayama have been shown to reduce the resting respiratory rate, further they increase the vital capacity, timed vital capacity, Maximum voluntary ventilation, Breath holding time, Maximum expiratory pressure. Savitri pranayama is one of the unique pranayama techniques which involves slow, rhythmic, and deep breathing. This pranayama has an added advantage that it is effective even if it is done in lying down position .So it can be practiced by non-ambulatory patients too.

Aims & Objective: To compare changes in respiratory parameters in the subjects practicing Savitri Pranayama and with that of subjects not practicing any type of Pranayama.

Material and Methods: New entrants in yoga class of shivanand ashram, Ahmedabad were selected as subjects for this study & compared with control group- not performing any type of exercise or yoga. The test group were trained by a qualified instructor & then practiced savitri pranayama for 6 days in a week for 12 weeks. Peak Expiratory Flow Rate, Maximum Breathing Capacity, Expiratory pressure, 40mm endurance test, Breath holding time were recorded twice in test group - before starting pranayama & after 12 weeks. Readings of control group were taken in both phases too.

Results: First phase recording showed no significant differences in any of the tested parameters between Test and Control groups. Second phase recordings showed significant differences in all the tested parameters between Test and Control groups.

Conclusion: In the test group there is statistically significant increase in PEFr, MBC, EP, 40mm endurance test & BHT. So it is concluded that a practice of Savitri Pranayama has beneficial respiratory effects. This pranayama can be practiced by bedridden & physically handicap persons. It has psychological effect for relaxing the patients so can be practiced for mental well-being.

Key-Words: Savitri Pranayama; Peak Expiratory Flow Rate; Maximum Breathing Capacity; Expiratory Pressure; 40mm Endurance Test; Breath Holding Time

Introduction

Human being born today also has same physical equipment as the men in prehistoric ancestors, but vast changes have occurred in the environment created by man. These changes have benefited, but have also created problems that are difficult to manage. Therefore for proper functioning of our body even in the present polluted environment a portion of our time should be spent in practice of yoga. The whole system of yoga is built on three main structures: exercise, breathing and meditation. Breathing techniques are based on the concept that breath is the source of life in the body. Yoga is a science which has been practiced in India from over thousands of years. It is one of the best lifestyle modifications which have ever been devised in the history of mankind. Yoga makes the mind calm & relaxed, strengthens & tunes the body, brings them into harmony with

each other. Pranayama have been shown to reduce the resting respiratory rate, further they increase the vital capacity, timed vital capacity, Maximum voluntary ventilation, Breath holding time, Maximum expiratory pressure.^[2,8] Yoga therapy readjusts the autonomic imbalance, controls the rate of breathing and thus alters various physiological variables.^[3] Yogic practices, an ancient culture of Indian heritage, have led to ideal physical, mental, intellectual, and spiritual health. Yoga has a number of beneficial physiological effects on various systems in our body. Regular yogic practices have been shown to cause profound improvement in cardio respiratory, thermoregulatory and psychological functions in healthy individuals. Yogic practices have been also found to be most useful in alleviating hypertension, bronchial asthma, diabetes mellitus, and coronary artery disease.^[4] Pranayama helps in bringing conscious awareness

to breathing & the reshaping of breathing habits & patterns. The essence of the pranayama practice is slow breathing which is economical as 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. Thus, a yoga practitioner, through pranayama, can at some stage control other physiological functions and finally control manifestations of prana even outside the body.^[5] Pranayama is the art of controlling the life force of breath, so it has become a standard fare at health clubs & community recreation programs. Pranayama means control of 'prana'. "Prana" in Indian philosophy, refers to all forms of energy in the universe. Life force in an individual is symbolized by breathing. Breath is a dynamic bridge between the body and mind.^[5] Savitri pranayama is one of the unique pranayama techniques which involves slow, rhythmic, and deep breathing in a 2:1:2:1 pattern incorporating a safer and milder form of breath holding. The duration of the hold in (kumbhak) and hold out (shunyak) phases is only for half that of the inspiration (purak) and expiration (rechak) phases. This pranayama is usually taught as a relaxing and rejuvenating practice and can be done in either sitting or supine position. Savitri is the feminine form of Savitu, 'the Sun', and is hence referred to as the 'goddess of solar harmony'. This pranayama has an added advantage that it is effective even if it is done in lying down position, so it can be practiced by non-ambulatory patients too.

This study was planned with the aim to compare changes in respiratory parameters in the subjects practicing Savitri Pranayama and with that of subjects not practicing any type of Pranayama.

Materials and Methods

We selected new entrants in yoga class of shivanand ashram, Ahmedabad as subjects for this study. All subjects were non-smokers and were not on any medication during this study. They were motivated to undergo Savitri Pranayama training. The subjects were familiarized with the setup and detailed instructions and demonstrations were given to their satisfaction. Statistician was contacted to know the correct size

of population need to be studied. Out of 45 subjects 30 were selected who could do savitri pranayama competently. They did savitri pranayama for 15 minutes daily sitting in sukhasan, for 6 days a week, minimum for 12 weeks under the guidance of yoga instructor. The control group consisted of age and sex matched 30 subjects, not practicing any kind of yoga and Pranayama. Informed and written consent was taken from the subjects of both the groups. Two phases of reading were taken. In study group, 1st phase of reading was taken before commencement of pranayama practice and 2nd phase of reading after the cessation of pranayama that is after 12 weeks. Two phases of readings were taken in control group also. Along with that anthropometric parameters like height, weight and BMI were also measured in both the groups.

1. Peak Expiratory Flow Rate (PEFR) & Maximum breathing capacity (MBC) were measured using instrument 'Medispiror' brand by 'Recorders and medicare systems', Chandigarh. It is a type of flow sensing digital spirometer. The instrument is capable of giving reproducible test results and represents the major advancement in computerized pulmonary function testing. Subjects were allowed to sit comfortably in a chair, asked to take deep inspiration via nose with mouth closed and then pinch their nose with left hand & blow forcefully in mouthpiece. This was repeated three to four times & highest value was recorded for data.
2. Expiratory pressure and 40 mm endurance test were determined by using a Mercury Manometer. Expiratory pressure is recorded by taking deep inspiration & pinch the nose with left hand to prevent escaping of air from nostril, then blowing force fully in rubber tube of sphygmomanometer by single attempt pushing the mercury column up & reading was noted. For 40mm endurance test subject was asked to inspire deeply & after pinching the nose blow into the tube of sphygmomanometer to take the mercury column to 40mm mark. Maximum time up to which the level of mercury column can be held steadily at 40 mmHg was noted.

3. Breath Holding Time was determined by using a stop-watch. Subjects were asked to hold their breath after normal expiration and the maximum time up to which it can be held was determined.

All this recordings were taken between 7 to 8 am. Data analysis was done using Independent sample t-test and P value < 0.005 was considered as statistically significant.

Results

First phase recording showed no significant differences in any of the tested parameters between Test and Control groups. Second phase recordings showed significant differences in all the tested parameters between Test and Control groups.

Table-1: Comparison of First Phase of Readings in Test and Control Groups before Starting the Practice of Pranayam

| | PEFR (L/sec) | MBC (L/min) | Expiratory Pressure (mmHg) | 40 mm Endurance Test (sec) | BHT (sec) |
|---------|----------------|-----------------|----------------------------|----------------------------|-----------------|
| Test | 4.33 ± 0.41 | 97.50 ± 7.11 | 80 ± 4.2 | 21.1 ± 3.9 | 23.52 ± 0.49 |
| Control | 4.35 ± 0.42 | 94.63 ± 5.25 | 82 ± 3.4 | 20.2 ± 2.3 | 23.24 ± 0.88 |
| P value | 0.859 | 0.595 | 0.702 | 0.704 | 0.651 |

Table-2: Comparison of Second Phase of Readings in Test and Control Groups after 12 Weeks Practice of Pranayam

| | PEFR (L/sec) | MBC (L/min) | Expiratory Pressure (mmHg) | 40 mm Endurance Test (sec) | BHT (sec) |
|---------|----------------|------------------|----------------------------|----------------------------|-----------------|
| Test | 5.96 ± 1.12 | 117.34 ± 14.4 | 113 ± 6.3 | 29.9 ± 3.2 | 30.07 ± 3.38 |
| Control | 4.28 ± 1.22 | 96.48 ± 3.33 | 86 ± 1.4 | 22.2 ± 4.3 | 21.56 ± 1.64 |
| P value | < 0.005 | < 0.005 | < 0.005 | < 0.005 | < 0.005 |

Discussion

Breathing is the only autonomic function that can be consciously controlled and it is the key in bringing the sympathetic & the parasympathetic nervous system into harmony. Breath is the only function through which we can influence the involuntary nervous system. Few studies have explained that, during pranayama training, regular inspiration & expiration for prolonged period leads the lungs to inflate & deflate maximally which causes strengthening & increased endurance of the respiratory muscles.^[6]

Peak expiratory flow rate (PEFR) is the expiratory flow rate during the peak of Forced Vital Capacity. Its measurement helps to assess the degree of opening of small airway passages. Pranayama involves using of lung spaces, which is not used up in normal shallow breathing, so increased PEFR might be a consequence of small airway openings in lungs.^[4] Possible explanation for increased maximum breathing capacity & expiratory pressure could be regular deep inhalation and exhalation for prolonged period leads to strengthening of respiratory muscles. Increase in BHT & 40mm endurance test may be due to increase in tolerance to high pCO₂ and low pO₂ achieved due to training of pranayama. The diaphragm descends 1.5 cm during quiet breathing, but during deep vertical breathing it descends 6 to 7 cm, increasing vertical diameter of thoracic cavity. Total diaphragmatic surface is 270 cm². Every 1 cm descend of diaphragm will increase the thoracic cage cavity by 270 cc with an intrapulmonary pressure of -3 mmHg. During deep breathing diaphragm descends as a result intrapulmonary pressure will become about -6 mmHg facilitating more air entry into the lungs improving vital capacity. By regular practice of pranayama respiratory center in medulla oblongata is brought under volition. In pranayama the individual continues the phase of inhalation with his strong voluntary control so that lungs are expanded considerably and the walls of the alveoli are stretched to the maximum thus the chest continues to get expanded under cortical control. The stretch receptors are thus trained to withstand more and more stretching which helps to hold the breath for a long period. The duration is gradually increased so that respiratory center is gradually acclimatized to withstand higher pCO₂ and lower pO₂. CO₂ stimulates the chemoreceptors located in the medulla oblongata that are sensitive to the amount of CO₂ concentration in blood, which in turn send the impulses to the respiratory centre. The respiratory centre which could have otherwise started exhalation is now helpless against the strong voluntary control from the cortex. So in many ways the individual practicing pranayama is actually training the chemoreceptor to tolerate more and more tensions. As the CO₂ goes on accumulating during breath holding, the chemoreceptors report it promptly to the pneumotaxic center which tries to stimulate

expiratory centre. The autonomic or the reflex mechanism of respiration is far more powerful than the control from higher centers that's why after a particular stage it is not possible to hold the breath further. The receptors get acclimatized to the increased concentration of CO₂ gradually by regular practice of pranayama. Present study showed significant improvement in respiratory parameters. Previous studies done by Mamatha SD, Shankarappa V & Dr madanmohan also showed similar changes in respiratory parameters.^[4,6,7] The mechanism of how pranayamic breathing interacts with the nervous system affecting metabolism and autonomic functions is not clearly understood. It has been hypothesized that voluntary slow deep breathing functionally resets the autonomic nervous system through stretch-induced inhibitory signals and hyperpolarization currents propagated through both neural and non-neural tissue which synchronizes neural elements in the heart, lungs, limbic system and cortex. During inspiration, stretching of lung tissue produces inhibitory signals by action of slowly adapting stretch receptors (SARs) and hyperpolarization current by action of fibroblasts. Both inhibitory impulses and hyperpolarization current are known to synchronize neural elements leading to the modulation of the nervous system and decreased metabolic activity indicative of the parasympathetic state.^[9]

Conclusion

In the test group there is statistically significant increase in PEF, MBC, EP, 40 mm endurance test & BHT. So it is concluded that a practice of Savitri

Pranayama has beneficial respiratory effects. This resultant effect of pranayama can be used as a lung strengthening tool to treat many lung diseases like asthma, allergic bronchitis and many occupational diseases.

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