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Original Scientific Paper

Effect of Yoga Similiris Practice on Pulmonary Function

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Abstract: *There are numerous studies that indicate the positive impact of yoga on health. Among other things, it is known that certain yoga asanas if practiced continuously and regularly have positive effects on the human body. Primarily on pulmonary function, cardiac work and endocrine glands. It is believed that yoga exercises may interact with different somatosensory-neuro-endocrine mechanisms and hence their therapeutic effect. Our study was aimed at monitoring the effects of Similiris yoga program on pulmonary function,with lung function tests FEV1 (forced expiratory volume in one second) and PEF (peak expiratory flow rate). Similiris yoga program involves the practice of hatha yoga asanas and pranayama practice. The study included 93 patients of both sexes between 18 and 25 years of age, who during the six-month period regularly and continuously practiced yoga exercises twice a week for 90 minutes. Lung function measurements were performed with Microlife digital spirometer in two phases: Phase 1, before and after the first hour of similiris program, Phase 2 measurements were conducted last moment after 6 months of exercise. The results obtained in phase 1 show that there was no statistically significant difference in the change in FEV1 before and after class, still in phase 2 there is a statistically significant difference compared to the measurements in the first phase 2, 87 ± 1.07 L / min, while in Phase 2 values were 3.14 ± 0.87 L / min. When it comes to stage 1 for PEF amounted to 3.22 ± 1.1 L / s, while phase 2 was 5:43 + / - 1.7 L / s. The results obtained in phase1 show that there was no statistically significant difference in the change in FEV1 and PEF ($p > 0.05$), still in phase 2 there was a highly statistically significant difference compared with measurements of FEV1 and PEF in phase 1 ($p < 0.001$). This has shown that the practice of yoga similiris has positive influence on lung function.*

Key words: *yoga, similiris, pulmonary function tests, FEV1, PEF*

Introduction

Yoga is a branch of ancient Indian philosophy. The root of the Sanskrit word "yoga" has many meanings, one of which is "to unite" or "pair", and refers to the unity of the individual with the universal consciousness beings (or "Absolute"). Yoga also describes the union of the physical body with the mind and spirit, as well as the method by which transcends the ego and achieve enlightenment (*Ramacharaka*, 2002).

In 19th century few Western scientists have been interested in yoga. In 20th century there was a period of expansion of interest for yoga and beneficial effect of yoga on stress and its consequences, which the modern man increasingly felt (*Kent,* 2002). In addition, articles today indicate important place of yoga in the prevention and treatment of many health problems in

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modern man. It is because of its philosophy and basic principles of moderation, yoga becomes more and more present in the world.

Yoga, the association of physical, mental and spiritual being, is much more than practicing. Yoga is essentially a way of life. An integral part of yoga asanas and meditation (energy recovery) is breathing, and breathing techniques.
Life is completely addicted to the act of breathing. "Breathing is life." Although there is differencies in the details of the theory and terminology of both East and West ,they agree on basic principles. Literally,life depends on breathing,generally breathing is the key. Namely, vitality and health dependent on correct breathing habits. Conscious control of our breathing power improves the quality of everyday life, giving us increased vitality and resistance. On contrary, unintelligent and careless breathing results in a shorter life, vitality and reduce our susceptibility to disease (*Fraser*, 2002).

Breathing is a highly integrated process which involves complex of mechanisms in the brain, brain stem, spinal cord, cranial and spinal nerves, with the coordinated functioning of the diaphragm, intercostal muscles, larynx, pharynx, lungs and cardiovascular system. Breathing can be described as a spontaneous, rhythmic mechanical process. Respiratory cycle was unconscious process over again (*Fraser*, 2002). This does not mean that we can not breathe enough to control and make it more efficient. External respiration takes place in two stages, inspiratory (inhalation – active phase) and expiratory (exhaling – passive phase). The movement of air to the lungs is the active phase of the external breathing or inhaling. It is caused by the expansion of the chest wall and dropping down the diaphragm. A normal respiratory cycle is 12-16 breaths per minute, and the volume of air inhaled in one breath about 500ml. In the passive phase of breathing diaphragm is lifted up, and the chest wall narrowing what lead to increasing the pressure inside the lungs and passive release of air from the shallower to the environment. Effective breathing is essential in the practice of yoga. At the time of exhalation can be achieved by stretching a bit more in intense and demanding master asanas. Similarly without proper breathing can not be achieved relaxation and peace of mind. Shallow breathing leads to lack of energy for daily life, reduced immune response, leads to increased risk of disease and increased irritability (*Kent,* 2002). Yoga calms and relaxes the mind and strengthens and tones the body and bring them into harmony (*Shankarappa, Prashanth, Nachal, Varunmalhotra*, 2012).

Method

The study included 93 individuals of both sexes between 18 and 25 years of age, who during the six month period regularly and continuously practiced yoga exercises twice a week for 90 minutes. The control group of 87 individuals who volunteered to join the study, which has not practiced yoga, or deal with any other sporting activity during the study. Lung function measurements were performed with Microlife digital spirometer in two phases: Phase 1, before and after the first hour of similiris Phase 2 measurements were conducted last moment after 6 months of exercise.

Informed consent was taken from all patients who voluntarily signed up for the study. They were motivated by a certified instructor from the Yoga Federation of Serbia to practice yoga Similiris program for 6 months. Similiris yoga program involves a series of asanas of hatha yoga, which is practiced by precisely logic schedule and logicly followed with energy flow, in combination with certain pranayama practices (breathing techniques). An integral part of every workout similiris is the first part of preparation, that involves preparatory positions, then positions on the floor, Rishikesh series and energy recovery. All similiris asanas are from hatha yoga ,that complement one another. Activation of muscle agonists- anatgonisti retains all the natural

rhythm of pulsation. In that scedhule Pranayama techiques are integrated (*udjajji* breath, *nadi shodhana*, *kapalabhati*, *bastrika*).

Inclusion criteria:
- Healthy individuals who at enrollment had no experience of practicing yoga, between 18 and 25 years of age. (yoga group)
- Healthy individuals who at enrollment had no experience of practicing yoga, between 18 and 25 years of age. And that during the 6 months of the study have not practiced other sports. (control group)

Exclusion criteria:
- People with a history of systemic diseases, such as diabetes mellitus, hipertensio arterialis, autoimmune disease, connective tissue disease ...
- People who were treated with beta agonists
- Patients with significant kyphosis or scoliosis caused a significant (eye visible) chest deformity

Anthropometric measurements (age, weight and height) were performed closer to the date of birth. Height was measured using a tape measure, expressed in centimeters (cm) in the standing position. Body weight was measured with scales, expressed in kilograms (kg). The same scale is used during the entire study, with frequent calibration after every 10 patients. Tab.1

Lung function tests:
Measurement of lung function tests were performed by a digital spirometer Microlife. Used computerized spirometer is selfcalibrating spirometer that meets the criteria for standard tests of lung function. The measurement was carried on in several occasions: the first time a student came before her/his first yoga class, and the second time just after the end of the same class. The third and fourth measurements were performed in the same manner and at the same time (before and after class), after 6 months of practicing yoga in continuity. All subjects practiced continuously for 6 months with the regularity of 95%, that practitioners were absent from class on average 2 hours during the period of the study.

Procedure
To all individuals were explained in detail the procedure and measurement . They were stimulated to breathe force breathing immediately after a deep breath in a sequel that is an integral part of the spirometer. Exhaling lasted from 3 to 4 seconds. On the nose to each of them it was small pinchholder to prevent the passage of air through the nostrils. Each individual had three measurements, and the highest values recorded were taken into account and were included in the statistical analysis. All measurements were performed in the standing position. In addition, at the same time, in 7pm, before the start or after the end of classes at 9pm. All measurements were performed in a quiet environment ,so emotional and physiological response to stress (caused by external influences) toned down.

Table 1. General characteristics of respondents

	N 93	N 87
AGE	20.1 ± 0.6	22.0 ± 0,7
BODY HEIGHT(cm)	165.1 ± 7.5	168 ± 6.2
BODY WEIGHT (kg)	57.3 ± 6.0	64,1±4,9

BMI (kg/m2)	21.5 ± 2.2	22,3± 1,7

Results

In the yoga group, the results obtained in Phase 1 show that there was no statistically significant difference in the change in FEV1 before and after class, still in phase 2 there is a statistically significant difference compared to the measurements in the first phase 2, 87 ± 1.07 L / min, in phase 2 values were 3.14 ± 0.87 L / min. When it comes to phase1 for PEF amounted to 3.22 ± 1.1 L / s, while phase 2 was 5:43 + / - 1.7 L / s. In the control group there were no significant changes in the measured parameters at baseline ,compared to those measured after 6 months. Table 2

Table 2. Lung volumes in the research phases

p< 0.05*,
p< 0.01**

	Yoga group N 93		Control group N 87	
Research phase	PHASE 1	PHASE 2	PHASE 1	PHASE2
FEV1 L/min	2, 87 ± 1,07	3,14 ± 0,87 *	1.2± 1,1	1,4± 0.06
PEF L/s	3,22±1,1	5.43 +/- 1.7*	3,11±1,4	3,80± 1,0

Discussion

Yoga is a holistic discipline, so balance is the central principle (*Kent,* 2002). Hourly, yoga class was divided equally on the asanas, breathing exercises, relaxation time, and energy renewal. Because of this, every part of the body, brain and mind was given the same amount of attention and has equal importance. Breathing is the only autonomous functions that can be consciously controlled, it is essential to harmonize the sympathetic and parasympathetic nervous system (*Grover, Varma, Pershad, Verma*, 1998).
Numerous studies have shown that just by practicing yoga can contribute to a better balance of integral parts of the autonomic nervous system, which controls breathing rate which entails an impact on a number of physiological mechanisms (*Ernst, Ram, Holloway, Jones,* 2003).

Yoga practice leads to improved lung function. Numerous studies have dealt with the examination of the effects of yoga on the respiratory and cardiovascular system. That is why Nagarathna and Nagendra (1985), Murthy et al (1984), Kumar et al (1985), Singh et al (1990), Jain et al (1993) and Singh (1987), in their studies showed improvement in asthma, the use of *pranayama* and control breathing exercises (*Nagarathna, Nagendra*, 1985; *Murthy, Sahay, Sitaramaraju et al*, 1984; *Kumar, Kumari, Kumari et al*, 1985; *Singh, Wisniewski, Britton, Tattersfield*, 1990; *Jain, Talukdar*, 1993; *Singh*, 1987). However, there are studies that indicate the absence of *pranayama* benefits in people with asthma (*Khanam, Sachdeva, Guleria, Deepak*, 1996; *Cooper, Oborne, Newton et al*, 2003; *Vedanthan, Kesavalu, Murthy et al*, 1998).

Besides Joshi and his group of researchers suggests improving FEV1 in women, not in men (*Joshi, Joshi, Gokhale*, 1992). Similar results are obtained from Stanescu in Belgium who 's study data showed that there was no statistically significant improvement in FEV1 in the yoga group compared with the control group (*Stanescu, Nemery, Veriter, Marechal,* 1981).

Regard to this, our study included a complete program that includes exercises and asanas, pranayama and energy recovery. Our results in accordance with the results of those who have shown improvement in lung function. We are taking into account the healthy individuals and some of the individual studies had to focus people with respiratory ailments-asthma. Even in people with asthma it was seen progress toward better. Not only in terms of lung function tests but also when it comes to the mental stability of patients with asthma. In fact, asthma is a disease that involves the existence of increased resistance in the airways, forcing a reduction in respiratory volumes, flow rate, pulmonary hyperventilation and increased respiratory work and he believes that it is essential mental stability of an individual suffering from asthma. Just practicing yoga individuals with asthma increases their sense of control over stress and initiate autonomous factors in asthma attack (*Sodhi, Singh, Dandona*, 2009).

The reason for this lies in the fact that yoga balances the work of the autonomic nervous system, in favor of the parasympathetic nervous system, which is," brakes activated sympathetic nervous system. Several studies have shown that yoga can rearrange autonomic imbalance, gain control respiratory rate, reaching the control of inspiratory and expiratory muscles (*Ernst*, 2000; *Ram, Holloway, Jones*, 2003) - primarily controls the diaphragm, which is a key respiratory muscles, with additional control of intercostal muscles (which reduces the reactivity of the sympathetic, and essentially represents the biggest challenge of asthmatic individuals). With yoga, people attained respiratory efficiency, balance of antagonistic respiratory muscles.

This all makes sense if you start from the fact that yoga is an ancient discipline "older than archeology" (*Kent,* 2002), where the mental and physical component integrated through regular practice. Considering that respiratory function is dependent on many factors including the function nervous system, respiratory muscle strength and lung condition come to the place of yoga conditioning, and proper functioning of the respiratory system integration. That is why Mandanmohan has showed that the short-term practice of yoga (for 6 weeks) significantly affected the respiratory muscles to gain strength and increase lung volume in children (*Mandanmohan, Jatiya, Udupa, Bhavanani*, 2003).
Practicing yoga people can also improve muscle strength and flexibility (*Raub*, 2002), maximum of expiratory tension (*Yadav, Das,* 2001) and feeling for proper breathing (*Villien, Yu, Barthelemy, Jammes*, 2005).

The main function of the lungs is gas exchange (O_2 and CO_2), for the sake of adequate cell respiration. Pulmonary gas exchange depends predominantly of ventilation-perfusion ratio. Physiologically there is a difference in the natural ventilation-perfusion (V / Q) ratio in different parts of the lungs. Thus, the upper parts of the lung (upper third, peaks lung), this ratio is in favor of ventilation, secondary pulmonary parties are approximately equal, while in the lower parts of the lungs (basal Party) this ratio in favor of perfusion (*Guyton, Hall*, 2010).

This relationship is not the same in all parts of the lungs especially in shallow breathing. With Yoga people learn to become aware of all parts of the lung, and thus knowingly engage in the process of breathing (eg triple yoga breathing). In this regard, as opposed to an individual who is not practicing yoga and that predominantly uses peaks lungs breathing, the person practicing yoga using a significantly larger capacity. Research conducted Chanavirut, shows that the expansion of

the chest wall adds to the better ventilated parts of the lung (*Chanavirut, Khaidjapho, Jaree, Pongnaratorn*, 2006).

As Similiris is comprehensive yoga program, we believe that for this reason our results indicate any research to improve lung function. Similar claims Halvorson, who says that yoga stretching and balanced movements can lead to improved muscle strength and flexibility (*Halvorson*, 2002).

With Yoga we move from dominant chest pass to the predominantly abdominal breathing. Specifically thorax breathing engage to a greater extent intercostal and auxiliary respiratory muscles: m.trapezius, mm.scaleni, m. pectoralis major et minor m.sternocleidomastoideus (*Levenson*, 1992; *Frownfelter*, 1987; *Chaitow, Bradely*, 2002). Therefore, it is less efficient, it delivers air into the lower lungs, and engage tired neck muscles and shoulders, and it is associated with anxiety and tension (*Gilbert*, 1999). On the other hand predominantly abdominal breathing engages the diaphragm, which is matched to the shape of the lung. That's why respiration is done with the least effort, which is associated with a sense of mental stability and calmness (*Chanavirut, Khaidjapho, Jaree, Pongnaratorn*, 2006).

Conclusion

Scientific data that we obtained in this study support the existence of the benefits that yoga has on the respiratory function. The study has shown that practicing yoga with medium intensive effort of similiris positions and breathing techniques, significantly affect the volume of the lungs and have a significant impact as an additional therapeutic tool in the treatment of certain disorders of lung function.

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