ORIGINAL ARTICLE

YOGA TRAINING WITH MEDITATION AMELIORATES THE ASTHMATIC ATTACK BY IMPROVING PULMONARY FUNCTIONS: A PILOT STUDY

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ABSTRACT

The concept that yoga is helpful for the treatment of bronchial asthma has created great interest in the medical research field. In order to investigate whether physiological parameters and pulmonary functions were improved in asthmatic patients after yoga training, the present study was conducted on seventy patients with bronchial asthma.
The present study was conducted on seventy patients with asthma who were on beta 2 agonist inhalers and yoga therapy for three months.
Parameters like pulse rate, respiratory rate, body weight, FVC, FEV1, FEV2, FEV1% and PEFR were compared with controls on beta 2 agonist inhalers alone.
Yogic practices resulted in significant improvement in pulmonary functions; decrease in respiratory rate; decrease in pulse rate and body weight (not statistically significant); decrease in frequency of asthma attacks and decrease in frequency of use of inhalers. The disease status in controls deteriorated.
Potential explanations for improvement in case group are effect on release of endorphins, balance of ANS and effect on airway smooth muscle dynamics.

Key words: yoga, asthma, pulmonary functions, beta2 agonists.

INTRODUCTION

The term psychosomatic disease is reserved for the group of diseases in which psychological factors are primarily or predominantly involved in causing, aggravating or perpetuating the disease. They are also called psycho- physiological disorders in order to emphasize the fact that psychological factors produce physiological changes which in turn are responsible for the development of abnormal clinical features. The concept of psychosomatic medicine has gained popularity in this decade much more than at any other time. The psychosomatic disorders commonly involve the autonomic nervous system which controls the body's internal organs. Modern medical and behavioral studies are revealing that a physical break down under stress does not necessarily occur due to causes imposed from outside a person such as infections, environmental agents, combined with exhaustion or physical trauma. It can also be due to life experiences, thoughts, emotions and behavior and personality structure. Evidence is gradually emerging about psychological factors and personality traits contributing to specific diseases. Among the growing list is cancer, asthma, migraine, peptic ulcer, hay fever etc

Asthma is considered by many to be a prototype of psychosomatic illness. Around 0.5 to 2% of our population suffers from asthma. Asthma is considered to have a multi-dimensional etiology which includes allergic, infective, climatic, endocrine, and emotional factors.[1] In most patients with asthma there is a strong psychological aspect. Indeed many regard asthma as a psychoneurosis and the allergy manifestation as secondary to psychoneurosis. Psychological stress is known to trigger asthma via the vagus nerve.[2] A great deal can be done symptomatically for most patients suffering from asthma. To relieve the bronchiolar obstruction adrenaline, salbutamol, aminophylline, steroid therapy etc can be given. Long term therapy with these drugs is successful but the patient comes to depend on these drugs.[3] Studies emphasize the importance of a psychological theory in asthma.[4] Hence in the treatment of asthma various psychological interventions have been implemented. Of these

interventions the role of yoga as a therapy is gaining momemtum.[5]

Yoga derived from the Sanskrit word 'yuj' means union, is a spiritual practice that uses the body, breath and mind to energize and balance the whole person The importance of yoga related to medicine is mainly in getting a method of mental relaxation in view of the tremendous increase in the stress and strain of life, especially in urban areas. Yoga helps to slow down an overactive mind while, at the same time toning up the body, removing toxins and relieving pains, backache and injuries.[6] Nagarathna and Nagendra (1993) conducted a study on the physiological changes in sports teachers following three month of yoga training.[7] The study showed a significant increase in peak expiratory flow rate (PEFR), Forced expiratory volume in first second (FEV_1) and forced vital capacity (FVC) and a significant decrease in heart rate, respiratory rate, systolic and diastolic BP recording and body weight. Kulkarni and Dater (1997) reported the effects of short term yoga training in both males and females could increase the PEFR.[8] Relaxation therapy can significantly contribute to the standard treatment of asthma in adult patients was reported by Rittz (2001).[9] Increase in PEFR in asthmatic patients by sahaja yoga training was demonstrated by Monacha (2002).[10] Recently, Sodhi et al. (2009) reported that yoga breathing exercise when used adjunctively with standard pharmacological treatment significantly improves pulmonary functions in patients with bronchial asthma.[11] However, the effect of long term yoga training along with meditation (dhyana) in patients with bronchial asthma has not yet been established. Hence, the present study aimed to evaluate the effect of yoga training with meditation in patients with bronchial asthma.

MATERIALS AND METHODS

Seventy patients were included in the study with thirty five patients in case group and thirty five in control group. Institutional ethical committee approved this study and written consent was obtained from each patient included in the study. The study was conducted in Dept of Physiology and Dept of Holistic medicine, Government Medical College, Thiruvananthapuram, Kerala. Thirty five non smoking asthmatic patients, 20 male and 15 female patients of 20 to 60 years age group, who were on beta 2 agonist inhalation therapy reporting voluntarily to holistic medicine out patients department for practicing yoga were included in the study. Patients with h/o respiratory tract infections, any lung disease other than asthma leading to dyspnea, cardiac or any other illness (detected history wise or on clinical examination), current smokers, alcoholics, pregnant and lactating women were excluded from the study.

The control group patients, 20 male and 15 female patients of 20 to 60 years age group, were taken from the Respiratory medicine out patients Department, Pulayanarkotta, Thiruvananthapuram, Kerala. Both the case and control group were matched for age, sex, f/h of asthma and drugs (beta-2 agonist inhalation therapy). Physiological parameters like pulse rate (PR), respiratory rate (RR), body mass index (BMI) and pulmonary functions such as FVC, FEV1, FEV2 and PEFR were assessed on the first visit. Pulmonary functions were assessed using Medspiror, an electronic PFT machine which is a dry type of spirometer. After recording the pulmonary functions of both groups, the patients in the case group were subjected to yoga therapy, which included breathing exercise or pranayama, suryanamaskara, yogasanas (tadasana, matsyasana, bhujangasana and dhanurasana) and dhyana. A trained yoga instructor in the holistic medicine department gave yoga training to the case group daily one hour for 15 days. The patients were then asked to do yoga practice, one hour daily at home and to keep a record of the practice done. These patients were then assessed after three months using Medspiror.

Statistical analysis

The data of both the groups were then statistically assessed using SPSS of windows version 10. Association among variables was assessed using Pearson Chi-Square test. P value of less than 0.05 was considered as significant.

RESULTS

Both the case group and the control groups were assessed before the onset of study. The yoga intervention was given only to the case group and comparison of results before and after yoga was done. Similarly the control group was also assessed before and after three month. After the period of three months, both the control group and the case group were compared once again. Majority of patients in the control and case groups were belonged to age 40-59 yrs. The difference in the mean age of both groups was found to be statistically insignificant ($p > 0.05$).

Table 1: Comparison of PR, RR and BMI between control and case group at the onset and after 3 months of yoga training

	Group	Onset of study	After 3 months
Pulse rate (PR)	Control	83.78 ± 9.51	84.51 ± 9.34
	Case	79.89 ± 9.60 [ns]	77.65 ± 6.88 [a]
Respiratory rate (RR)	Control	21.88 ± 3.67	22.97 ± 3.51
	Case	16.40 ± 3.97 [a]	14.69 ± 2.96 [a]
Body mass index (BMI)	Control	24.13 ± 2.65	24.35 ± 2.42
	Case	24.54 ± 2.96 [ns]	23.94 ± 2.81 [ns]

Values are mean ± SD

[a] $p < 0.01$ significantly different from control group; [ns] $p > 0.05$ non-significantly different from control group.

There was no statistically significant difference in the pulse rate between the two groups before the onset of study (table 1). Mean value of pulse rate after yogic exercises has decreased to 77.65 compared to its previous value of 79.89 in the case group. But this difference was not statistically significant. Highly significant difference in the pulse rate was noted between the case group and control group after 3 months of the study. The case group has a mean pulse rate of 77.65 and the control group has 84.51.

In the respiratory rate, highly significant difference was noted after yoga practice. After three months, the respiratory rate in the case group had a mean value of 14.69 while that in the control group was 22.97 and this difference was found to be statistically significant.

Table 2: Comparison of pulmonary function of the case group and the control group at the onset and after 3 months of study

	Groups	Onset	After 3 months
FVC	Control	2.41 ± 0.49	2.22 ± 0.48
	Case	2.09 ± 0.55[b]	2.32 ± 0.56[ns]
FEV1	Control	1.56 ± 0.37	1.38 ± 0.39
	Case	1.23 ± 0.34 [a]	1.57 ± 0.36[b]
FEV2	Control	1.88 ± 0.35	1.78 ± 0.46
	Case	1.66 ± 0.48 [b]	1.90 ± 0.47 [ns]
FEV%	Control	64.37 ± 9.30	61.48 ± 10.74
	Case	60.06 ± 10.58 [ns]	68.96 ± 13.97 [b]
PEFR	Control	5.70 ± 1.12	4.80 ± 0.84
	Case	3.58 ± 1.4[a]	4.28 ± 1.28 [b]

Values are mean ± SD

[a] $p < 0.01$ and [b] $p < 0.05$ significantly different from control group. [NS] $p > 0.05$ non significantly different from control group.

There was no significant difference in BMI between the control group and the case group at the onset of study. The mean BMI of the case group before yoga was 24.54 and after yoga intervention the mean BMI has decreased to 23.95. This difference was analyzed statistically and was found to be insignificant.

Comparison of pulmonary function of the case group and the control group at the onset and after 3 months of study is depicted in table 2. All the pulmonary functions were improved in the yoga trained group. Except for FEV% all the parameters showed statistically significant difference between the case and control group at the onset of study. After 3 months, FVC and FEV2 showed no significant difference between the two groups while FEV1, FEV% and PEFR showed significant difference between the two groups.

DISCUSSION:

Asthma is a distressing disorder of the bronchial tubes characterized by recurrent attacks of wheezing, coughing and a sense of suffocation resulting in difficulty in breathing. Causal factors for asthma tend to overlap variably from one person to another. On a psychological level suppression of negative emotions such as anger, jealousy, resentment and hatred are often precipitating causes as are loneliness, longing for affection, emotional hypersensitivity, fear of rejection etc. In the management of asthma through yoga these psychic factors are brought before the conscious mind. Increase in anxiety can lead to hyperventilation this can thus precipitate or aggravate asthma. Often the result is still more anxiety and in a vicious cycle, more hyperventilation this is further aggravated by inefficient mechanisms of breathing in asthma whereby increasing efforts leads to increased collapse of airways.[12]

While modern medicine aims at immediate relief, yoga aims at removal of the basic cause. Thus in yoga the attack on any diseased condition is holistic, since it is recognized that the mind is central in any diseased condition, the control and quietening of the mental state would heal the disease to a great extend.[13] Yoga therapy tries to establish the inner balance by various means, working from the gross to the subtle. Yoga has claimed that tension is disease and relaxation is health. All branches of yoga incorporate three major techniques: breathing, exercise and meditation. Some say it work like other mind body therapies and relieves stress; others believe that yoga promotes the release of endorphins in the brain.[14]

The physiological parameters taken into consideration in the present study were pulse rate, respiratory rate and body mass index. There was no significant difference in pulse rate between the case and control group at the onset of study. But at the end of three months, it was seen that highly significant difference in pulse rate was present with a higher pulse rate noted in the control group. Available literature on yogic studies revealed that the effect on pulse rate varied according to the type of yoga. In Siddhasana and Virasana, heart rate increases due to increased metabolism.[15, 16] While after a few months of Hatha Yoga training there was improvement in cardiovascular function as shown by an increase in physical capacity and decrease in heart rate.[17] In another study by Ramarao **(1990)**, no change in pulse rate was noted after yoga practice.[18]

In the present study, both the case and control group were on beta 2 agonist and their pulse rates had a mean value of 79.8 and 83.7. After the intervention of yogic practices the pulse rate in the case group decreased from a mean of 79.8 to 77.6. This may be due to yogic practices like shavasana which caused decrease in metabolic rate.[19] Yogic asanas are similar to physical training which increase the effectiveness with which the circulation adapts to exercise. Therefore, for a given expenditure of energy the stroke volume of the heart is greater and heart rate is decreased hence decrease in pulse rate.[20]

In the present study, it was also noted that there was a significant decrease in respiratory rate in asthmatic

patients after yoga therapy. By performing yogic breathing, the subject while keeping his other skeletal muscles relaxed and immobile, exercises a close, continuous, voluntary control over his respiratory muscles. The subject may change his ordinary rate of 15-18 to 1-2 resp/minute and reduce his ventilation volume a great deal.[21] The respiratory centres as a group are also under voluntary control and we are able to stop our respiration at least for little time at any phase of the respiratory cycle. The respiratory centres are continuously in receipt of many type of afferent impulses which cause a cyclical waxing and waning of its sensitivity. Not only the impulses initiated by pCO_2 and pO_2 but also the impulses from the stretch receptors of the lungs and the higher centres, decide the sensitivity of the centre. During the apnoea time, these impulses increases the sensitivity of the centre to such a level that finally the voluntary control breaks down. A short period of conscious control of the rate and depth of breathing as a health-promoting exercise has claimed wide human interest.[22] Usually breathing is not a conscious event and is regulated automatically by bulbopontine respiratory control mechanisms, which are further modified by suprapontine mechanisms. In the conscious being the pneumotaxic centre is supposed to relay suprapontine messages which promote voluntary inspiration and expiration.[23] During daily practice of pranayamic breathing the basic activity of bulbopontine complex is modified in such a way as to slow down its rhythm by voluntarily prolonging the phase of inspiration and expiration by stretching to their fullest extent, thus making respiratory apparatus to work to maximal extent.[24] Thus we may hypothesize that by voluntarily practicing pranayamic breathing for few weeks the bulbopontine complex is adjusted to new pattern of breathing which is slower than its basal rhythm.

Of the 70 patients included in the present study, 24 patients had BMI more than 25 in the control and case group. After yoga therapy in the case group no statistically significant difference was noted. But in the control group fourteen patients had BMI more than 25. The remarkable body weight changes as seen with the practice of yogic Asanas reported by Udupa et al.[25] (1972) have not been observed in the present study. A similar study conducted on the patients doing Shanthi Kriya has shown significant decrease in body weight probably due to the vegetarian diet.[26] In the present study, both the control group and case group were advised to follow strict diet but we do not have quantitative data on adherence of the patients to the diet pattern between the actual sessions or during the post intervention follow up period.

Before of the onset of study both the case group and control group were compared and statistically significant difference was noted with the asthma more severe in the case group (table 2). This difference may be due to the fact that the case group was taken from Holistic medicine out patients department, where the patients reported voluntarily. Those patients were on medications for a prolonged period with no relief and their drug usage was increasing day by day. Further, it was noted that those patients had better education and socio-economic status and hence willing to try out an alternative measure in addition to medicines. The number of attacks of asthma and drug intake was decreased in the case group. The control group, taken from respiratory medicine outpatient department had no significant improvement in pulmonary functions after three months, further they had to increase drug dosage and number of attacks of asthma reported during this period was more compared to the case group. It is important to note that the role of yoga was assessed as an adjuvant treatment. All subjects had been taking beta-2 agonist inhalation and continued their treatment through out the intervention and follow up period. Hence the benefits of yoga are in addition to the benefits of drugs. In specific depressive conditions the HPA axis is hypo reactive.[27] This causes hypo function of the hypothalamic corticotrophin releasing hormones neurons, which, in failing to modulate the immune inflammatory process, could give rise to increased inflammatory manifestations. The mechanism by which yoga acts is by reducing psychological over activity and emotional instability. Slow breathing which is done in yoga, had a broncho-protective and broncho-relaxing effect and a positive endogenous corticosteroid release. Udupa et al. (1972) observed an increased adreno cortical activity in practitioners of yoga.[25] The accelerated adreno cortical functions may produce varying degrees of stress competence. This increase in corticosteroid level may be a probable cause of decrease in asthmatic attacks in the case group after the practice of yoga.

Respiration is directly linked with the autonomic nervous system, which controls physiological arousal. Autonomic tone is mediated through cAMP and cGMP interactions. Balance between cAMP and cGMP controls the assembly of proteins into microtubules which is necessary to produce contraction of smooth muscles.[28] The levels of cAMP and cGMP are affected by the sympathetic and the vagal nerves. The sympathetic through the beta adrenergic receptors increase cAMP causing muscle relaxation and through alpha receptors increase in cGMP and causes contraction. In asthmatics alpha receptors are increased and beta receptors are decreased. The sympathetic over activity in stress may be acting through the alpha receptors causing broncho-constriction and increase in airway resistance.[29] Relaxation will reduce the blood levels of adrenaline and noradrenaline and increase the level of opoid neuropeptides which modulate the bronchial smooth muscle tone. Animal studies have reported that beta endorphins could influence bronchial smooth muscle tone.[30] Receptors for these neuropeptides are present in some neurons in the respiratory centres of the brain. Enkephalins also have a role in boosting up the immune system.[31]

In the present study, the case group reported an improvement in symptoms and this can be due to

release of enkephalin during meditation. Yogic process has a tremendous influence on the CNS. It helps an individual to gain control over the ANS, resulting in homeostatic functioning of the body. How ever, there is no definite model of sympathetic activity or relaxation during practice of meditation and there can be individual variations. Sirsasana is associated with increased sympathetic activity while savasana brings about a reduction in the sympathetic response.[32, 33] Several workers have found an increase in alpha synchrony in EEG taken during transcendental meditation, which points to its stabilizing effect on the nervous system.[34] Yoga clearly relaxes the muscles, and this deep physical and mental relaxation associated with the physiological changes seen in patients after daily yoga seems to have a stabilizing effect on bronchial reactivity, thus making the vagal efferents less excitable.

The reduction in psychological hyper reactivity and emotional instability achieved by yoga can reduce efferent vagal reactivity, which has been recognized as the mediator of the psychosomatic factor in asthma leading to bronchodilation. In the present study the highly significant improvement in FEV and PEFR in the case group was also attributed to the effect of yoga on vagal efferent activity. Pranayama helps to improve the function of respiration by giving exercise to muscles of respiration and by its influence on the respiratory centres. Pranayama increases blood circulation also. As lung tissue becomes more elastic and the surrounding muscle more flexible, the practice of pranayama can also increase lung capacity. The yogic practices like kapalabhati and bhastrika are very useful in strengtening respiratory muscles, esp the diaphragm. These would be valuable in delaying exhaustion in asthma attacks or respiratory insufficiency. Yogic asanas are isometric exercises that involve a coordinated action of synergic and antagonist muscles in bringing about steadiness and flexibility. Another possible mechanism by which yogic techniques bring relief in asthma in the present study may be by decreasing the metabolic rate. It is proved that certain asanas especially shavasana can decrease the metabolic rate and hence decrease the oxygen consumption. The decrease in metabolic rate can be by decreasing the catecholamine secretion and depressing the sympathetic function.[35]

The result of this study concluded that due to physio-psycho spiritual nature of yoga it can be usefully applied in the management of asthma. The conclusion of this study is generalisable to subjects with symptomatic asthma who express interest in the non pharmacological therapies but may not be applicable to patients who are antipathetic to this form of treatment. Yoga is not the sole treatment for a disease, but where the disease has already crept in; yoga techniques are powerful allies in the control of disease along with modern medicine.

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