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EFFECT OF YOGA ON PULMONARY FUNCTION TESTS OF HYPOTHYROID PATIENTS

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Abstract : Aim of this study was to see any effect on respiratory functions in hypothyroid patients after pranayama (yoga). The subjects for the study were 20 hypothyroid females, 39.70±8.27 years of mean age referred from medicine department of UCMS & G.T.B. Hospital. Spiro metric recordings were taken with hypair (version-1.28). Baseline (first) recordings were taken when patient came for the first time. Patients came to yoga lab in physiology department for 21 days continuously where they were trained by the yoga instructors and then told to do pranayama at home and called at regular intervals after 7 days to see the compliance. The breathing exercises were done for 45 minutes everyday. After 6 months of pranayama second recording was taken and compared with the baseline. There were significant improvement in forced expiratory volume in first second (FEV1), Maximum voluntary ventilation (MVV) and Inspiratory Capacity(IC). Thus Pranayama and meditation has beneficial effect on pulmonary functions of hypothyroid patients along with conventional treatment.

Key words : pulmonary function yoga hypothyroidism

INTRODUCTION

Hypothyroidism is defined as a clinical state resulting from insufficient secretion of thyroid hormone from thyroid gland due to some structural or functional impairment of thyroid hormone production. Hypothyroidism affects all the organ systems. Main clinical findings are fatigue, weakness, dryness and coarseness of the skin, cold intolerance, swelling of extremities, lack of concentration and memory, constipation and weight gain, menorrhagia, paresthesia, hearing disorder, diffuse alopecia, bradycardia, delayed relaxation of tendon reflexes, carpel tunnel syndrome, serous cavitary effusion (1). All sign and symptoms recover after replacement of thyroid hormone (2). Studies have shown that both myxedema and hypothyroid states produce depression of hypoxic ventilatory drive that is responsive to replacement therapy. This alteration in ventilatory control may contribute to the hypoventilation seen in myxedema and hypothyroidism (3). Hypothyroidism affects respiratory muscle strength which is linearly

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related to the thyroid hormone levels. Respiratory muscle weakness is present in both inspiratory and expiratory muscles and is reversible with treatment (4). Studies have shown that sleep apnea episodes are common in person with untreated hypothyroidism even with normal lung function. Thyroxin replacement therapy decreases apnea frequency, even without change in body weight (2). Yoga has been found to be beneficial in many diseases. It is called the science of self-realization and based on moral percepts, ascetic and meditation techniques and special type of physical training, which includes the control of posture and respiration. Yogic exercise improves body functions through the manipulation of cardiovascular, respiratory, metabolic control mechanism (5). It appears that the type and duration of the period of yogic practice determine its specific effect on the system. Pranayama (breathing techniques) in yoga means tackling the life energy through strict breathing disciplines associated with certain physical postures thereby ensuring regulation of health. Although endurance training is not associated with altered serum concentration of T4 or T3, several studies have found an exercise – induced increased turn over of both T4 and T3. But there exists no study concerning the effect of pranayama on PFTs of hypothyroid patients. Therefore aim was to assess the respiratory function of patients with clinical hypothyroidism before and after 6 months of pranayama.

In this study, we evaluated the respiratory function in hypothyroid patients. Our aim was to determine if respiratory functions were improved in hypothyroid patients when pranayama is combined with conventional treatment.

MATERIALS AND METHODS

Participants

The study was conducted in the Department of Physiology, University College of Medical Sciences & G.T.B. Hospital, New Delhi. The subjects for the study group were 20 female patients between 39.70±8.27 years of mean age with BMI 28.678±3.21, recruited after taking their informed consent. The subjects of control group (n=20) were healthy volunteers. Subjects with chronic disease or with organ system dysfunction were excluded. Spirometric recordings were performed with Hypair compact (version 1.28) medisoft S.A Belgium. Baseline recording was taken when patient came for the first time and second recording was taken after six months of yoga (practice of pranayamas and meditation). They were asked to practice yoga techniques daily in the form of pranayama (breathing techniques) and meditation, for at least 6 months. Patients came to yoga lab in physiology department for 21 days continuously where they were trained by instructors and then told to do pranayama at home and called at regular intervals after 7 days to see the compliance. The breathing exercises were done for 45 minutes everyday. The Pranayama were followed by a deep relaxation technique, which was performed for 6 minutes with closed eyes with specific instructions relating to awareness and relaxation of different parts of the body. The pranayama phase consisted of Kapalabhathi, Bhastrika, Bhramari, Ujjai and a slow breathing technique with alternate nostril breathing callled Anulom Vilom. At the end of the pranayama, OM chanting was done and subjects assumed the supine posture in a totally relaxed state with closed eyes (also

called the corpse posture or shavasana) for 3–6 minutes, in which the aim was to achieve an awareness of relaxation of every part of the body. Meditation practices were performed in the sitting position starting with breath awareness and relaxation. More detailed descriptions of these techniques are available in yogic texts (6).

TABLE I: Approximate time frame for the pranayama training program exercise.

Pranayama training program exercise	*Time*
(a) Kapalbathi	10 min
(b) Bhastrika	5 min
(c) Ujjai	7-11 times (3-5 min)
(d) Anulom vilom	15 min
(e) OM chanting	5-7 times (3-5 min)
(f) Bhramri	5-7 times (3-5 min)

Parameters

All subjects were assessed for the following parameters before starting yogic training and after 6 months of pranayama.

TSH estimation carried out with standard kit. Pulmonary function tests recorded were FEV1, FVC, FEV/FVC, PEFR, PEF, MVV and IC.

Statistical analysis of data

The data obtained was analyzed using SPSS software (Version 13.0). All respiratory parameters including FVC, FEV1, FEV1/FVC%, PEFR, MVV, IC were assessed. Paired "t" test was used for analysis of comparison between two states i.e. Baseline (pre-yoga) and post-yoga. Unpaired 't' test was used to compare normal controls with hypothyroid patients. Pearson correlation method was used to analyze the correlation of TSH levels with various PFTs parameters in hypothyroid patients. Results are expressed as Mean±S.D. $P<0.05$ was considered as significant.

RESULTS

Anthropometric parameters, serum TSH, and spirometric parameters of hypothyroid patients are shown in Table II, III and IV, respectively. Table V shows comparison of normal controls with hypothyroid patients there is significant decrease of all PFT parameters in hypothyroid patient (pre-yoga group) as compared to normal controls.

TABLE II: Demographic features of control subjects and hypothyroid patients.

	Control subject	*Hypothyroid patients*
Age (years)	35.65±6.53	39.70±8.27
Weight (kg)	56.20±8.12	66.33±10.14*
Height (cm)	155.10±2.24	152.13±3.42
BMI (kg/m^2)	23.36±3.85	28.67±3.21

Data presented are Mean±SD. *P<0.05

TABLE III: TSH value of subjects of the hypothyroid groups.

	Hypothyroid (pre-yoga)	*Hypothyroid (post yoga)*
TSH (µlU/ml)	13.67±10.22	9.10±8.57

TABLE IV: Spirometry parameters of the controls and hypothyroid patients.

	Control subjects	*Hypothyroids (pre-yoga)*	*P values*
FEV1(Lts)	2.86±0.67	1.89±0.26	0.000
FVC(Lts)	3.34±0.73	2.26±0.38	0.000
FEV1/FVC %	86.65±3.62	79.97±4.43	0.000
MVV(Lts/min)	103.11±8.70	72.72±3.20	0.000
PEFR(Lts/sec)	4.063±1.15	3.02±1.07	0.017
PEF (25) (Lts/sec)	2.60±0.91	0.79±0.41	0.000
IC(Lts)	2.97±0.66	1.80±0.34	0.000

The comparison between pre yoga and post yoga state demonstrated that all of the spirometric parameters were improved after yoga as compared to pre yoga reading i.e. taken before practicing pranayama and meditation. Significant improvement was found in FEV1 (P=0.003). Significant improvement were found in maximimum voluntary ventilation and inspiratory

capacity as compared to baseline shown in Table V. PEFR and PEF (25) have shown marked improvement (P=0.007, P=0.002 respectively). There was a negative correlation between TSH and FVC (r= –0.219, P=0.43), PEF(25) r= –0.490, P=0.460) & PEFR (r= –0.482, P=0.420) as shown in Table VI.

TABLE V: Spirometry parameters of the hypothyroid subjects before and after yoga practice.

	Control subjects	*Hypothyroids (pre-yoga)*	*P values*
FEV1 (Lts)	1.89±0.26	2.05±0.26	0.003
FVC(Lts)	2.26±0.38	2.39±0.43	0.131
FEV1/FVC %	79.97±4.43	81.32±5.59	0.052
MVV(Lts/min)	72.72±3.20	77.09±14.43	0.001
PEFR(Lts/sec)	3.02±1.07	3.73±1.23	0.007
PEF(25)(Lts/sec)	0.79±0.41	0.90±0.33	0.002
IC(Lts)	1.80±0.34	1.89±0.35	0.000

TABLE VI: Correlation of TSH with PFT parameters.

	R value	*P value*
FVC	–0.219	0.431
PEF(25)	–0.490	0.460
PEFR	–0.481	0.420

DISCUSSION

Yoga is a state which is defined as a high level of consciousness achieved through a fully rested relaxed body and a fully awake and relaxed mind (7). The effect of yoga on body function may be related to decreased arousal or a decrease in sympathetic nervous system activity. Meditation or relaxation according to yogic scriptures is a calming of the mind, slowing of the breath and relaxation of the muscles (8-10), and this is consistent with the effect of small changes in the psychological state on heart rate, respiratory rate and energy expenditure which might cause improvement of PFTs (11-13). Previous studies have demonstrated that transcendental meditation, Zen meditation, Yogic meditation and certain pranayama and relaxation techniques reduce O_2 consumption, metabolic rate, heart rate, pulse rate, breath rate and increases CO_2 elimination measured immediately prior to, during and after the meditation or relaxation techniques (13–16, 7, 11).

Literature search reveals many studies regarding the effects of clinical hypothyroidism on neural, respiratory and cardiovascular systems. The decrease in both expiratory and inspiratory muscle strength, alveolar hypoventilation due to depression of hypoxic and hypercapnoeic ventilatory drives and decrease in maximal breathing and diffusing capacity are evident in patients with hypothyroidism (17-19). In the present study there is significant decrease in PFT parameters in hypothyroid patients as compared to controls. These impairments might be reversible with hormone replacement therapy. Respiratory infections are more common in hypothyroid patients than healthy people which might be the cause of low PFT parameters (20, 21). Yoga strengthens the immunity through transcriptional regulation which might be the causes of decrease incidence of infections and improvement in PFT parameters (22, 23).

The prominent features like somnolence, apathy and lethargy may also recover with replacement therapy (24, 25). Muscle strength measurement and sleep investigation is not routine analysis in these patients, so simple spirometric evaluation is preferred. Thus, we used only spirometric measurements in our study since this method is easier, more available and cheaper than other respiratory function tests. In contrast to the reduced physiological and metabolic activity observed during meditation and relaxation posture types of asana, pranayamas and other specific asanas could acutely increase the metabolic rate. An increase of 19% in oxygen consumption has been observed during the

practice of one type of pranayama called the Ujjayi Pranayama (26). Breathing through a particular nostril, while performing the Surya Anuloma Viloma (right nostril breathing), has been shown to increase oxygen consumption by 28% (24). Studies have shown a lower up take of radioiodine by the thyroid gland after endurance training in both human and rat. Wilson et al reported that twenty four hour iodine uptake values appeared to fall from 30% to 24% after 3 weeks of exercise while the uptake values rose to 28% after two weeks of cessation of exercise (27).

Koral et al have shown the advantages of thyroid hormone replacement therapy, at least regarding respiratory function, seem to be clearly present in patients with overt, clinical hypothyroidism but not in patients with sub clinical hypothyroidism but in our study improvement is seen after six months of yoga therapy although role of thyroid hormone can not be totally ruled out. Literature says pranayama is considered as breathing exercise. Data has been reported on effects of exercise on the thyroid hormone metabolism, increase and decrease in thyroid hormone levels have been reported; the results have been inconsistent or even contradictory (28-30). These divergent results may be due to differences in the intensity of work, duration of exercise, frequency and design of the training program, and to differences in gender and age of the subjects. In addition, different duration of studies, timing of sampling after exercise and methodological factors in hormonal assay and data analysis may also be responsible for the discrepancies. Study of Wen Sheng huang have shown that Maximal treadmill exercise does not greatly affect the determination of concentrations of circulating thyroid hormones (28, 30–31).

Siafakas et al, found significant decrease in the strength of inspiratory and expiratory muscles in patients with clinical hypothyroidism (17). In the mentioned study, vital capacity (VC), forced vital capacity (FVC), forced vital capacity one second (FEV1), FEV1/FVC were significantly lower in patients with clinical hypothyroidism compared to healthy controls. In the present study hypothyroid patients before yoga had significantly lower spirometric parameters such as FEV1, FEV1/FVC%, FEF25-75, PEFR,MVV, IC as compared to post yoga this might be due to increase in strength of respiratory muscles as a result of regular pranayama. Earlier reports on respiratory failure in hypothyroidism had postulated a critical role for respiratory muscle weakness in the genesis of hypercapnia. Since hypercapnia was rapidly reversed despite the persistence of severe respiratory muscle weakness, this explanation may not be always correct. Study of weiner etal has shown that thyroid replacement had its primary effect on the respiratory control system but the role of yoga on improvement of respiratory control requires further studies (32).

We conclude that yoga has beneficial effect on pulmonary function tests of hypothyroid patients due to improvement in respiratory muscle strength and increased air entry which increase oxygen concentration at tissue level. All the patients were on drug treatment (thyroxin) for last 2-3 years so we can say most of the effect which has come in last six months is due to yoga. Thus Pranayama and meditation can be promoted as a breathing technique for improvement of PFTs in hypothyroid patients along with conventional treatment.

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