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A study on influence of pranayama on high sensitivity C-reactive protein and creatinine kinase levels in chronic obstructive pulmonary disease patients

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Abstract

Purpose: The present study is aimed to observe the differential response of pranayama in reducing high sensitivity C-reactive protein and creatinine kinase levels among chronic obstructive pulmonary disease patients in comparison to control patients.

Material and Methods: An intervention study was done by enrolling 100 chronic obstructive pulmonary disease patients who were managed by therapeutics. The participants were divided into intervention and non-intervention group with 50 each sample. The intervention was in the form of sequenced yogic practices for 6 weeks. The pre-intervention and post-intervention inflammatory maker levels were estimated along with lung function estimation.

Results: The result was analyzed by descriptive statistics. The mean C-reactive protein, serum creatinine kinase value decreased from 9.53 to 7.85mg/L and from 145.01 to 140.57 U/L respectively following 6 weeks of yogic practices intervention. The observed values were found to be statistically significant ($p < 0.05$).

Conclusion: The statistically significant reduction in inflammatory makers, C-reactive protein and creatinine kinase level following 6-week yogic practices in chronic obstructive pulmonary disease patient suggests including such yogic interventions in the regular management protocols of chronic obstructive pulmonary disease patients.

Keywords: chronic obstructive pulmonary disease, yoga, pranayama, high sensitivity C-reactive protein, creatinine kinase



Анотація

Сурешбаладжи Р.А., Начал Аннамалай, Нивета П. Дослідження впливу пранаями на рівень високочутливого С-реактивного білка та креатинінкінази у пацієнтів з хронічною обструктивною хворобою легень.

Мета: Це дослідження спрямоване на спостереження за диференційованою реакцією пранаями на зниження високочутливого рівня С-реактивного білка та креатинінкінази у пацієнтів з хронічною обструктивною хворобою легень порівняно з пацієнтами контрольної групи.

Матеріали та методи: було проведено інтервенційне дослідження шляхом включення 100 пацієнтів із хронічною обструктивною хворобою легень, які отримували терапевтичне лікування. Учасники були розділені на інтервенційну та групу без втручання по 50 у кожній вибірці. Втручання відбувалося у формі послідовних йогічних практик протягом 6 тижнів. Рівні збудників запалення перед втручанням і після втручання оцінювали разом з оцінкою функції легень.

Результати: Результат проаналізовано за допомогою описової статистики. Середнє значення С-реактивного білка, сироваткової креатинінкінази зменшилося з 9,53 до 7,85 мг/л і з 145,01 до 140,57 ОД/л відповідно після 6 тижнів практики йоги. Виявлено, що спостережувані значення є статистично значущими ($p < 0,05$).

Висновок: статистично значуще зниження рівня збудників запалення, С-реактивного білка і креатинінкінази після 6-тижневих занять йогою у пацієнтів з хронічною обструктивною хворобою легень дозволяє включати такі йогічні втручання в регулярні протоколи лікування пацієнтів з хронічною обструктивною хворобою легень.

Ключові слова: хронічна обструктивна хвороба легень, йога, пранаяма, високочутливий С-реактивний білок, креатинінкіназа

Аннотация

Сурешбаладжи Р.А., Начал Аннамалай, Нивета П. Исследование влияния пранаямы на уровни С-реактивного белка высокой чувствительности и креатининкиназы у пациентов с хронической обструктивной болезнью легких.

Цель: Настоящее исследование направлено на наблюдение дифференциальной реакции пранаямы на снижение уровней высокочувствительного С-реактивного белка и креатининкиназы у пациентов с хронической обструктивной болезнью легких по сравнению с пациентами контрольной группы.

Материалы и методы. Было проведено интервенционное исследование с участием 100 пациентов с хронической обструктивной болезнью легких, которые лечились терапевтическими методами. Участники были разделены на группы вмешательства и группы невмешательства по 50 человек в каждой. Вмешательство проводилось в форме последовательных йогических практик в течение 6 недель. Уровни производителей воспалительного процесса до и после вмешательства оценивались вместе с оценкой функции легких.

Результаты: результат был проанализирован с помощью описательной статистики. Среднее значение С-реактивного белка и креатининкиназы сыворотки снизилось с 9,53 до 7,85 мг / л и с 145,01 до 140,57 Ед / л соответственно после 6 недель занятий йогой. Наблюдаемые значения оказались статистически значимыми ($p < 0,05$).

Заключение: статистически значимое снижение уровня воспалительных факторов, С-реактивного белка и креатининкиназы после 6-недельных занятий йогой у пациента с хронической обструктивной болезнью легких предполагает включение таких йогических вмешательств в протоколы регулярного ведения пациентов с хронической обструктивной болезнью легких.

Ключевые слова: хроническая обструктивная болезнь легких, йога, пранаяма, С-реактивный белок высокой чувствительности, креатининкиназа



Introduction

Chronic Obstructive Pulmonary Diseases (COPD) refers to group of progressive lung diseases causing obstructed airflow from lungs characterized by broncho-constriction, difficulty in breathing, chest discomfort, shortness of breath, chronic cough due to significant exposure to noxious particles or gases [1]. The classical examples of COPD are emphysema and chronic bronchitis. Chronic Obstructive Pulmonary Disease is the third leading cause of death worldwide, causing 3.23 million deaths in 2019 [2]. About 80% of these deaths occurs in low- and middle-income countries. COPD is second common cause of NCD-related deaths in India (age >30 years). The risk factors of COPD are smoking, occupational aerosols, indoor and outdoor pollution, dietary habits, co-morbidity and positive COPD family history. But not all COPD cases are smokers.

Non-invasive breathing test-spirometry is a gold standard test for diagnosis of COPD [3]. There are also biochemical markers that can be measured in respired breath, sputum, broncho-alveolar lavage and plasma of COPD patients. The measurement of biochemical markers in plasma is a more reliable method. The COPD patients can be successfully treated by inhaled bronchodilators, antibiotics, corticosteroids, oxygen, methyl xanthines, mucolytic agents and adjuvant therapy.

Pulmonary rehabilitation is a holistic approach that involves exercise therapy and behavior modification to improve health status in COPD. Exercise training and yoga have shown beneficial effects in COPD patients by reducing discomfort in breathing and fatigability, enhancing the exercise tolerance thereby improving quality of life [4].

Pranayama is a common yogic practice, consciously regulating one's own breath. It improves the resting respiratory rate, vital capacity, maximum voluntary ventilation, breath-holding time, maximal inspiratory, expiratory pressures, reduces dead-space ventilation and aerates the lung. Patients, who were trained to perform pranayama were observed to have increased inspiratory and expiratory muscle functions. Role of Pranayama is newly gaining importance in clinical research. The relationship between effect of yoga as an adjunctive therapy on respiratory function and respiratory muscle strength in COPD patients was evaluated using various spirometric parameters like FEV1%, PEF, FVC and FEV1/FVC ratio [5].

Meta analytic studies [6] have revealed that, respiratory interventions including pranayama would help to reduce inflammatory markers could

contribute to the prevention of various metabolic disorders and future cardiovascular events. COPD patients with systemic manifestations, circulating high levels of IL-6 were found to stimulate CRP synthesis by hepatocytes thus leading to increased levels of both the markers [7]. The study revealed the elevated serum creatine phosphokinase levels in obstructive lung disorders is probably derived from respiratory muscles, owing to the increased work of breathing [8]. The literature on pranayama intervention in COPD patients and its consequential alterations in inflammatory marker levels are scarcely available.

The present study is aimed to observe the differential response of pranayama in reducing hs-CRP and creatinine kinase levels among COPD patients in comparison to control patients.

Material and Methods

Study Area: A tertiary care hospital in rural Tiruchirappalli

Study Duration: From February-December 2020

Study Design: Interventional study

Sampling technique: Simple random sampling method

Sample Size: The sample size was calculated with 95% confidence level and 85% power with a p value of less than 0.05 is considered significant. Fifty subjects as interventional group (COPD + medication + pranayama) and 50 subjects (COPD + medication) as control group were taken. The participants included eligible subjects who have met the inclusion criteria.

Inclusion criteria: clinically confirmed COPD patients, aged 20 to 55 years of both genders; With mild to very severe stable physician-confirmed COPD satisfying Global Initiative for Obstructive Lung Disease (GOLD) criteria, those with forced expiratory volume 1 (FEV1)/forced vital capacity ratio <0.7 and post-bronchodilator FEV1<80% predicted; clinically stable for at least 3 months prior to enrollment, able to walk without aid, willing to complete all study assessments and provide informed consent.

Exclusion criteria: recently diagnosed COPD, epilepsy, unstable angina, respiratory tract infection within 1 month of the start of the study, myocardial infarction, angioplasty, heart surgery in the previous 6 months, Basal blood pressure >180/100 mmHg, resting PR >120 bpm, body mass index (BMI) >35 kg/m², previous participation in yoga rehabilitation programs, mentally retardation and related neuromuscular disorders.



Methodology

The study participants, 50 each were grouped into interventional and non-interventional group (randomized). The participants were stabilized on drugs till no further symptomatic improvement occurred. The participants in the interventional group received pranayama practice along with routine medications and the control group were maintained only on medication.

In this study, a combination of relaxation exercise to calm the mind followed by pranayama and asanas for 6 weeks as intervention is as follows:

- Kapalabhati for five minutes (successive rapid exhalations followed by passive inhalations)
- Anuloma-viloma pranayama for 10 minutes (holding one nostril closed with inhaling then holding other to exhale; then reversed and repeated)
- Bhastrika pranayama for five minutes (inhale through both nostrils maximum for four seconds and then exhale for six seconds)
- Sasangasana, 30 seconds each for five minutes (hands above the head, lean forward with exhalation, the forehead to touch the knees with hands to touch the floor and next get back to starting position with inhalation) and
- Bhramari for five minutes (sustained inhalation and slow exhalation with humming sound)

After 6 weeks of pranayama, base-line and post-intervention values were compared.

Care was taken to recruit subjects who were on standard care for COPD. Optimum therapy was defined as maximum dose of drugs administered without any side effects to produce maximum clinical benefit. Optimum dose was decided by the chest physician. It was assumed that 10% improvement in PFT is clinically significant and atleast 50% of the COPD patients will improve with yogic practice. Two inflammatory makers hs-CRP and serum creatinine kinase (sCK) were estimated in

baseline and post intervention period in both the groups.

All procedures were performed according to the Declaration of Helsinki [9] research ethics. Each participant received detailed information about the study and provided written informed consent prior to the study.

Statistical Analysis

The data was entered and analyzed using SPSS version 23. The descriptive statistical analysis was done by calculating percentages and p value. The results were computed for the variables and tabulated. The level of significance for the results was expressed using p value with $p < 0.05$ being statistically significant.

Results

In the interventional group of 50 participants, the mean age was 44.22, standard deviation was 1554.58 ± 9.78 and coefficient of variance was 12.61. The control groups of 50 participants showed mean age of 45.08, standard deviation was 1353.68 ± 6.92 and coefficient of variance was 11.54. CRP levels among the interventional group showed a mild to moderate reduction after follow up when compared to baseline. The mean CRP value decreased from 9.53 to 7.85mg/L after six weeks of yogic practice whereas the coefficient of variance value increased from 61.51 to 69.18 which were significant.

There was a significant reduction in the mean serum creatinine kinase level from 145.01 to 140.57 U/L, in the interventional group whereas the control group demonstrated an increase in serum creatinine kinase levels from 141.64 to 146.37 U/L. Overall this data showed very clearly that the interventional group improved better than the control group. Paired "t" test confirmed the statistical significance of the observed finding with significant $P < 0.05$ (Table 1).

Table 1

Base-line and post-intervention values

Outcome measures	Interventional group			Control group		
	Base-line	Post	p value	Base-line	Post	p value
Mean Age	44.22		0.002*	45.08		0.015*
Gender						
Male	23		0.17	22		0.16
Female	25		0.14	28		0.15
Transgender	2		0.001*	-		-
HsCRP(mg/L)	9.53	7.85	0.003*	9.93	8.42	0.015*
Creatine kinase	145.01	140.57	0.000*	141.64	146.37	0.003*

Notes: * statistically significant



Discussion

This study analyzed the hypothesis that pranayama used as an adjunctive therapy in COPD patients showed improvement in serum inflammatory markers like hs-CRP and creatinine kinase levels among COPD patients.

A report on effect of pranayama upon respiratory health detailed the different mechanisms involved in potentiating efficiency of lungs of individuals through promoting abdominal respiration and providing relief to the diaphragm and also the effect on non-functional and closed airways were also described [10].

Subjective positive improvement in health and functional status with reduction in disease severity was observed following 3 months of pranayama practice in COPD patients [11]. Improvement in lung function parameters with reduction in overall symptoms was noted in moderate to severe COPD patients with yogic breathing and pranayama exercise [12].

Studies on effect of yoga on COPD patients documented improved lung functional parameters after yogic practice [13-15]. These beneficial studies on the practice of yoga for the COPD patients underlie the suggestion to use yogic practices as an adjunct therapy in COPD management.

Apart from respiratory functional improvement, yogic practices were also observed to cause reduction of biochemical inflammatory makers like CRP in COPD patients after 12 weeks yogic practice intervention [16]. In comparison the present study found statistically significant reduction in CRP levels ($p=0.003$) in intervention group that was given 6 weeks of yogic practice itself.

An increase in sCK levels due to increased work of breathing following an increase in the airway resistance and alveolar ventilation was described in COPD patients [17]. Our study showed a reduction in sCK levels which can be attributed to reduction in airway resistance among the intervention group following the positive effects of yogic practices.

Even though there are various studies regarding COPD and yogic practices, the current study is an emerging topic of interest because it interconnects the importance of practice of pranayama and biomarker levels in COPD patients. This study postulates a hypothesis that breathing techniques such as pranayama is more beneficial in

having favorable effects on pulmonary functions of COPD patients. The serum inflammatory markers like CRP and serum creatinine kinase levels in patients with COPD are reduced when compared to controls of COPD with medication alone. Yogic practices are considered as best adjunct therapy besides pharmacological practices [8].

Conclusion

The present study explains that among yogic asanas, pranayama is a unique method, as it is easy to understand and performed by patients. It requires less effort and provides drastic long-term comfort for COPD patients. It can be considered as a cost-effective rehabilitative technique in management of chronic obstructive lung diseases. The levels of CRP and CK were statistically reduced in COPD patients following 6 weeks of yogic practice as an adjunct to medication. This study concludes that these yogic practices could possibly bring in symptomatic relief in COPD patients. Thus regular practice of yogic breathing and exercise is advisable for COPD patients. Regular practice of pranayama can bring remarkable positive effects on both physical and mental well-being of an individual.

Therefore the study reveals that intervention of pranayama along with medications has significantly reduced the hsCRP and creatinine kinase levels. It can be concluded that Pranayama is an advisable supportive therapy for COPD management.

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Conflict of interest

None declared

Ethical approval

Institutional Ethics Committee approval obtained from Trichy SRM Medical College Hospital and Research Centre, Trichy. (Ref: No.14/ TSRMMCH&RC/ ME-1/ 2020-IEC No. 021 dated 31.01.2020).



References

1. Agarwal AK, Raja A, Brown BD. *Chronic Obstructive Pulmonary Disease*. Treasure Island (FL): StatPearls Publishing; 2021.
2. Geneva. World Health Organization. *Chronic obstructive pulmonary disease (COPD)*. [Document in the Internet]; 2021. Available from: [https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-\(copd\)](https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)).
3. USA. Global Initiative for Chronic Obstructive Lung Disease. *World COPD Day 2021* [Document in the Internet]; 2021. Available from: <https://goldcopd.org/world-copd-day/>
4. Zeng Y, Jiang F, Chen Y, Chen P, Cai S. Exercise assessments and trainings of pulmonary rehabilitation in COPD: a literature review. *Int J Chronic Obstructive Pulmonary Diseases*, 2018; 13: 2013-2023.
5. Sengupta P. Health impacts of yoga and pranayama: a state-of-the-art review. *Int J Preventive Medicine*, 2012; 3: 444-58.
6. Khanam AA, Sachdeva U, Guleria R, Deepak KK. Study of pulmonary and autonomic functions of asthma patients after yoga training. *Ind J Physiol Pharmacol*, 1996; 40: 318-24.
7. Yanbaeva DG, Dentener MA, Spruit MA, Duistermaat JJH, Kotz D, Passos VL. IL6 and CRP haplotypes are associated with COPD risk and systemic inflammation: a case-control study. *BMC Med Genet*, 2009; 10: 23-9.
8. Burki NK, Diamond L. Serum creatine phosphokinase activity in asthma. *Amer Rev Respir Dis*, 1977; 116: 327-31.
9. France. The World Medical Association Ethics Unit. *Declaration of Helsinki*. [Document in the Internet]; 2017. Available from: <http://www.wma.net/e/ethicsunit>.
10. Bijlani RL, Manjunatha S. Yoga. In: Bijlani RL, Manjunatha S, editors. *Understanding Medical Physiology: A Textbook for Medical Students*. New Delhi, India: Jaypee Brothers Medical Publishers; 2011. p. 743.
11. Gupta A, Gupta R, Sood S, Arkham M. Pranayam for treatment of chronic obstructive pulmonary disease: results from a randomized, controlled trial. *Integr Med (Encinitas)*, 2014; 13: 26-31.
12. Katiyar SK, Shailesh B. Role of pranayama in rehabilitation of COPD patients - a Randomized Controlled Study. *Ind J Allergy Asthma Immunol*, 2006; 20: 98-104.
13. Behera D. Yoga therapy in chronic bronchitis. *J Asso Physc India*, 1998; 46: 207-8.
14. Soni R, Munish K, Singh K, Singh S. Study of the effect of yoga training on diffusion capacity in chronic obstructive pulmonary disease patients: A controlled trial. *Int J Yoga*, 2012; 5: 123-7.
15. Karthik PS, Chandrasekhar M, Ambareesha K, Nikhil C. Effect of pranayama and suryanamaskar on pulmonary functions in medical students. *J Clin Diagn Res*, 2014; 8: BC04-6.
16. Shete SU, Verma A, Kulkarni DD, Bhogal RS. Effect of yoga training on inflammatory cytokines and C-reactive protein in employees of small-scale industries. *J Educ Hlth Promotion*, 2017; 6: 76-83.
17. Stephens I. Medical yoga therapy. *Children (Basel)*, 2017; 4: 12-9.
18. Kozina ZhL. Analiz i obobshchenie rezul'tatov prakticheskoy realizacii koncepcii individual'nogo podkhoda v trenirovochnom processe v sportivnykh igrakh [Analysis and generalization of results of practical realization of individual approach conception in trainings of sport games]. *Fizicheskoe vospitanie studentov tvorcheskikh special'nostej*. 2009; 2: 34-47.
19. Kozina ZL, Goloborodko YA, Boichuk YD, Sobko IM, Repko OO, Bazilyuk TA, et.al. The influence of a special technique for developing coordination abilities on the level of technical preparedness and development of psycho-physiological functions of young volleyball players 14-16 years of age. *Journal of Physical Education and Sport*. 2018; 18(3):1445-1454. DOI:10.7752/jpes.2018.03214
20. Kozina Z, Chebanu O, Repko O, Kozin S, Osiptsov A. Influence of typological features of the nervous system on individual performance in running for short distances in athletes with visual impairment on the example of an elite athlete. *Physical Activity Review*, 2018; 6:266-278

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