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Yoga-based pulmonary rehabilitation for the management of dyspnea in coal miners with chronic obstructive pulmonary disease: A randomized controlled trial



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ABSTRACT

Background: Coal mine dust exposure causes chronic airflow limitation in coal miners resulting in dyspnea, fatigue, and eventually chronic obstructive pulmonary disease (COPD). Yoga can alleviate dyspnea in COPD by improving ventilatory mechanics, reducing central neural drive, and partially restoring neuromechanical coupling of the respiratory system.

Objectives: To evaluate the effectiveness of Integrated Approach of Yoga Therapy (IAYT) in the management of dyspnea and fatigue in coal miners with COPD.

Materials and methods: Randomized, waitlist controlled, single-blind clinical trial. Eighty-one coal miners (36–60 years) with stable Stages II and III COPD were recruited. The yoga group received an IAYT module for COPD that included *asanas*, loosening exercises, breathing practices, *pranayama*, cyclic meditation, *yogic* counseling and lectures 90 min/day, 6 days/week for 12 weeks. Measurements of dyspnea and fatigue on the Borg scale, exercise capacity by the 6 min walk test, peripheral capillary oxygen saturation (SpO₂%), and pulse rate (PR) using pulse oximetry were made before and after the intervention.

Results: Statistically significant within group reductions in dyspnea ($P < 0.001$), fatigue ($P < 0.001$) scores, PR ($P < 0.001$), and significant improvements in SpO₂% ($P < 0.001$) and 6 min walk distance ($P < 0.001$) were observed in the yoga group; all except the last were significant compared to controls ($P < 0.001$).

Conclusions: Findings indicate that IAYT benefits coal miners with COPD, reducing dyspnea; fatigue and PR, and improving functional performance and peripheral capillary SpO₂%. Yoga can now be included as an adjunct to conventional therapy for pulmonary rehabilitation programs for COPD patients.

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by progressive airflow obstruction, which is mainly irreversible [1]. Evidence shows that coal miners suffer increased risk of coal mine dust lung disease including COPD as a respiratory hazard of coal mining [2]. Cumulative exposure to coal dust is associated with increased risk of airway limitation [3] resulting in dyspnea and fatigue on exertion limiting physical

activity [4], adversely affecting daily living [5] and quality of life [6]. Although dyspnea, “subjective experience breathing discomfort” [7] is considered the primary activity-limiting symptom in coal miners [8], other symptoms like fatigue the “subjective perception of mental or physical exhaustion due to exertion” [9] is a common feature in coal miners with COPD. It is one of the most frequently reported, distressing side effects reported by COPD patients, often having significant long-term consequences.

Pulmonary rehabilitation is a comprehensive intervention that includes exercise training, education, and behavior modification, designed to improve the physical and psychological condition of people with COPD [10]. The evidence is increasing for the efficacy of several kinds of exercise training as part of pulmonary rehabilitation aimed at reducing dyspnea and fatigue, as well as

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improving health-related quality of life and exercise capacity in individuals with COPD [11]. Yoga has been included as a component of exercises prescribed for many pulmonary rehabilitation programs [12]. It has also been included as an adjunct to physical therapy treatment in industrial rehabilitation programs and proven to enhance mind-body coordination [13]. Studies of short-term yoga practices have reported improved lung function parameters [14], increased diffusion capacity [15], decreased dyspnea-related distress [16], and improved health-related quality of life [17]. Yoga would show efficacy for coal miners with COPD, a topic on which no previous study appears to have been done.

The IAYT is a program which was first applied to asthma some 30 years ago [18]. Other than respiratory problems, benefits have been demonstrated for various disorders such as cancer [19,20], coronary artery bypass graft [21], hypertension [22], asthma [23], diabetes mellitus [24], osteoarthritis of knee [25], low back pain [26], anxiety and depression [27], autism spectrum disorder [28], and schizophrenia [29]. It includes *asanas*; *pranayama*; relaxation techniques; meditation; *yogic* counseling for stress management; chanting; and lectures on *yogic* lifestyle and philosophy [30].

Limited studies on COPD using other yoga systems have assessed its efficacy in an adjunctive role [14–17]. Here we report a randomized controlled study of coal miners with COPD, evaluating the effects of IAYT on dyspnea, fatigue, exercise tolerance, peripheral capillary oxygen saturation ($SpO_2\%$), and pulse rate (PR). We hypothesized that these parameters would improve in yoga group as compared to a control group, at least partly for reasons similar to its efficacy to asthma [18,23,31].

2. Materials and methods

2.1. Participants

The coal miners of Rampur Colliery, Odisha, India were recruited as study participants. The study sample consisted of 81 non-smoking male coal miners in the age range 36–60 years. Of 279 coal miners screened, 162 failed at least one exclusion criterion; another 36 refused informed consent for the investigation; 81 signed up for the trial, but after nine further dropouts, final data were only available for 72 participants (Fig. 1).

2.2. Inclusion criteria

Non-smoker male coal miners, aged 36–60 years, with moderate to 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 postbronchodilator 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 were included in the study.

2.3. Exclusion criteria

Patients with recent COPD exacerbation, unstable angina, respiratory tract infection within 1 month of the start of the study, myocardial infarction, angioplasty, heart surgery in the previous 3 months, basal blood pressure $> 180/100$ mmHg, resting PR > 120 bpm, body mass index (BMI) > 35 kg/m², injury-free, no history of

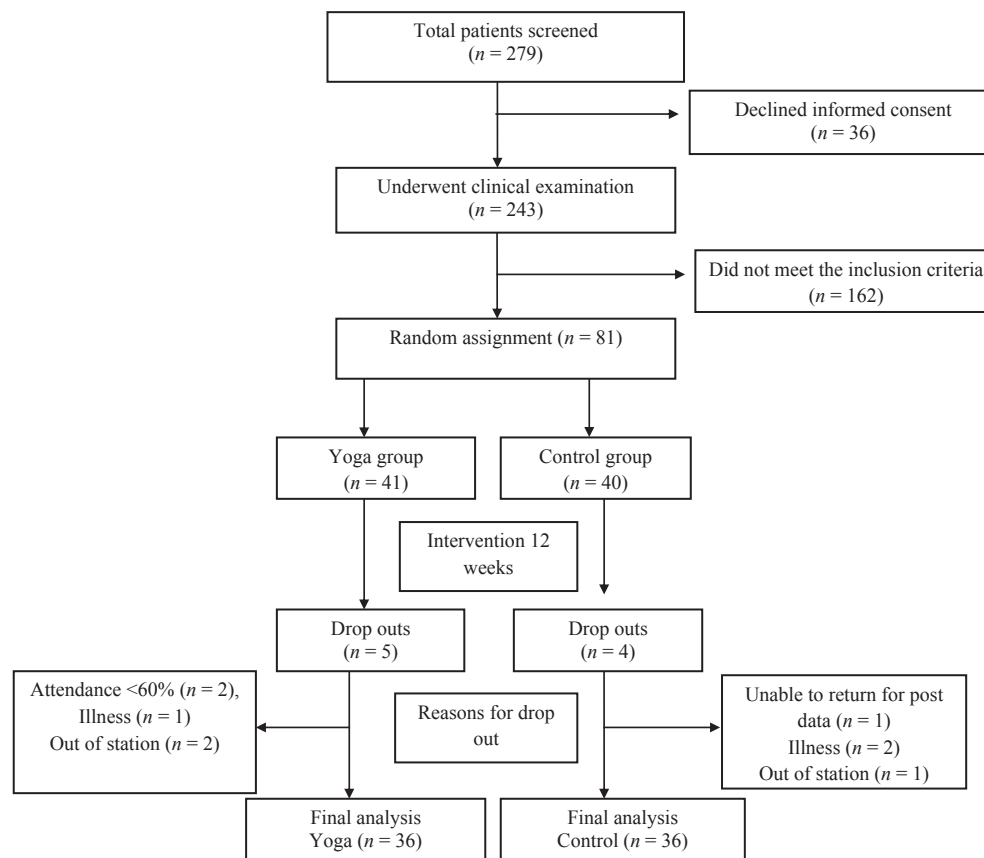


Fig. 1. Participant's flow chart

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