

Study of vitamins, antioxidant and trace elements on various spirometric parameters and quality of life in patients of bronchial asthma

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Abstract

Introduction: Imbalance between reactive oxygen species and antioxidant defence mechanism produce oxidative stress which further augments and aggravates airway inflammation in asthma. The objective of this study is to find out the effect of antioxidants, trace elements supplementation on pulmonary functions and quality of life in asthmatics.

Material and Methods: A prospective, interventional study was conducted in the department of Respiratory Medicine, K.G.M.U., Lucknow. 84 newly diagnosed patients of asthma were recruited. Patients were randomly allocated into two groups using lottery system. One group (A) were given only anti-asthmatic treatment while other group (B) received vitamin, antioxidant, trace element supplementation along with anti-asthmatic treatment. Spirometric parameters (FEV₁%) and quality of life were assessed at baseline and at regular intervals and the results were compared between the groups.

Results: In our study, males (58.33%) outnumbered females (41.67%). Maximum number of cases were in the age group 18-30 (39.29%) followed by 31-40 (25.00%). Mean age of patients was 35.9 ± 13.64 years. Mean ± SD of FEV₁% in group A was 72.3 ± 2.7 while in group B it was 72.7 ± 2.9, which showed that there was no statistically significant difference in spirometric parameters post treatment between the two groups (p= 0.3734). Similarly, quality of life also showed insignificant results (total score, p=0.1141).

Conclusion: From the results of our study, it was concluded that there was no additional benefit of vitamins, antioxidant, trace elements supplementation on pulmonary functions and quality of life in asthmatic patients.

Keywords: Asthma, Oxidative stress, Antioxidants, Quality of life, Spirometry.

Introduction

Bronchial asthma is a chronic inflammatory disease of the airways, characterized by hyper-responsiveness and airflow limitation leading to recurrent attacks of breathlessness, wheezing and disease exacerbation which varies in severity and frequency.¹ Its burden on society is enormous and imposes negative impact on the clinical outcome and quality of life of patient.

According to Global Asthma Report (2018) asthma affects approximately 339.4 million people worldwide and the prevalence increases by 50% every decade.² The occurrence of asthma deaths are over 80% in low and lower - middle income countries. WHO estimate of asthmatic patients in India is 15- 20 million.³ Globally prevalence of asthma increases by

50% every decade and estimated to range 3-38% in children and 2-12% in adults.⁴

Since it is disease with multiple etiologies, currently there is no definite cure for asthma, the disease can only be controlled and improved symptomatically with the help of medications. Inflammation of the bronchus is the hallmark of asthma and studies have shown that oxidative stress augment and aggravates airway inflammation. Imbalance between production of reactive oxygen species and antioxidant defence mechanism produce oxidative stress in the body.⁵

Environmental triggering factors make the respiratory tract susceptible to oxidative stress. Reactive oxygen species production as a result of oxidative stress causes inflammation which in turn

initiate sequence of events leading to oxidant mediated cellular injury. Studies have shown that patients with asthma are deficient in antioxidants leading to oxidative stress burden and pulmonary dysfunction.⁴ Oxidative stress initiated in the airway of bronchial asthma patient because of exogenous and endogenous reactive species leads to epithelial cell injury, induction of transforming growth factor β 1 secretion from epithelial cells resulting in remodeling of airway.⁵

Antioxidants keep the airway healthy by neutralizing the damaging effects of oxidative radicals. Enzymatic antioxidants such as superoxide dismutases, catalase, glutathione peroxidases require trace elements like Cu, Zn, Se to catalyze free radicals. Non-enzymatic antioxidants such as Vitamin A, E, C and a large group of flavenoids directly react with free radicals and reduce their potency.⁴ It has been hypothesized that essential elements may play an important roles in asthma genesis since they take part in oxidative stress reactions as cofactors of antioxidant enzymes.

Intracellular and extracellular fluid in lungs has vitamin C a free radical scavenger that protect against exogenous and endogenous free radicals.⁶ It is the most abundant antioxidant substance which contributes to regeneration of membrane bound oxidized vit E to function again and has an antihistaminic effect too. Vit E has a structural role in stabilizing membrane. By reducing external attacks in the lung and neutralizing oxidants effects, antioxidants vitamins modulate the development of asthma and the impairment of pulmonary function.⁶

Trace elements such as Cu, Zn, Se have an important role in inflammation, oxidant /antioxidant imbalance and may further affect the disease status. Zn has beneficial roles in respiratory epithelium: as an antioxidant, anti-inflammatory agent, antiapoptotic agent, cofactor for DNA synthesis .Se has a crucial role in the inflammatory asthmatic process with the ability to affect the adhesion molecules expression.⁷

Severity of airflow limitation, its reversibility, variability and confirmation of asthma can be assessed by measurement of lung function. Spirometry (FEV₁%) is the most commonly and widespread acceptance methods to assess airflow limitation.⁶

Antioxidant and trace element deficiencies seems to be important factors in this regard. There are no clinical trials producing concrete results suggestive of vitamins, antioxidants, trace elements role in clinical outlook of asthma.

Objectives

1. To describe demographic and health characteristics of patients receiving treatment for Bronchial asthma coming to OPD at the Department of Respiratory Medicine, K.G.M.U., Lucknow.
2. To assess and find out the relation between vitamins, antioxidant, trace elements supplementation and pulmonary functions at the Department of Respiratory Medicine, K.G.M.U., Lucknow.
3. To assess the improvement in spirometric parameters in patients of bronchial asthma after supplementation with vitamins, antioxidants and trace elements at the Department of Respiratory Medicine, K.G.M.U., Lucknow.
4. To assess the improvement in quality of life in patients of bronchial asthma after supplementation with vitamins, antioxidants and trace elements at the Department of Respiratory Medicine, K.G.M.U., Lucknow.

Material and Methods

The present study was an interventional study conducted in the Department of Pharmacology and Therapeutics, King George's Medical University, Lucknow in collaboration with Department of Respiratory Medicine OPD, King George's Medical University, Lucknow. The study was started only after getting the ethical approval from the Institutional Ethics Committee of King George's Medical University, Lucknow. 84 newly diagnosed patients of asthma were recruited for the study after fulfilling our inclusion exclusion criteria. Written informed consent was taken from the study subjects. The total duration of study was of 12 months.

Inclusion and exclusion criteria

Inclusion Criteria

1. Newly diagnosed patients of asthma.

2. Patients of either sex of age 18 to 60 years
3. Patients having no associated comorbidities
4. Mild to moderate asthma cases with FEV₁ >80% and 60-80%, FEV₁/FVC ratio normal to reduced 5%

Exclusion criteria

1. Unwilling patients and those who did not give consent for the study
2. Patients who are unable to give interview
3. Pregnancy / Breastfeeding
4. Patients with incomplete medical records.
5. Patients with other chronic disease
6. Terminally ill patients
7. Patients with concurrent major psychiatric illness and/or concurrent major medical illness.
8. Patients with severe asthma with FEV₁ <60% and FEV₁/FVC reduced > 5%.

The patients attending Respiratory medicine OPD and are newly diagnosed with asthma were recruited for the study. The diagnosis of asthma was made by detailed history, clinical symptoms, physical examination, investigations like pulmonary function tests (PFTs) - spirometry, Absolute Eosinophilic Count (AEC) and serum IgE levels. Once the diagnosis of asthma was confirmed patients were randomly allocated into two groups using lottery system. Group A patients were given anti-asthmatic treatment only while Group B patients received vitamin, antioxidant trace elements supplementation along with anti-asthmatic treatment. Record of any previous baseline investigations was also made. A Case Report Form (CRF) was designed as per the study protocol. It included patients demographic details - patients name, age, sex, occupation, residence, OPD registration number, presenting complaints and their duration, smoking history, family history of asthma, any previous treatment history or current treatment, associated comorbid conditions (such as HTN, Diabetes, TB, AIDS, heart disease etc), investigations

related to diagnosis such as pulmonary function tests, average eosinophilic count (AEC), serum IgE levels etc, drugs prescribed for asthma along with dosage, duration, frequency, route of administration. The patients were followed up at 2nd week, 4th week (1month), 12th week (3 month) and 6 months to assess the outcomes such as improvement in spirometric parameters (FEV₁, FEV₁/FVC) and quality of life. Quality of life was filled and assessed with the help of questionnaire- mini asthma quality of life (MQLQ) questionnaire at the time of enrollment of the patient (at baseline) and at follow up visits by interview method. Total of 84 patients will be enrolled into the study. The enrolled patients will be divided randomly into 2 groups:

1. Group A (42) – anti asthmatic treatment only
2. Group B (42) – anti asthmatic treatment + intervention (vitamins, antioxidant, trace element combination capsule)

At each visit spirometric parameters will be done along with the questionnaire related to any new symptom and improvement in quality of life

Statistical evaluation

Continuous variables are expressed as mean + SD and pre post data has been compared by student's t test. P values less than 0.05 will be considered as statistically significant.

Results

Demographic and health characteristics

84 patients were studied during the 12 months study period. The age group ranged from 18 years and above (Table 1). Maximum number of cases were in the age group 18-30 (39.29%) followed by 31-40 (25.00%). Majority (64.29%) of the patients were in the age group of 18-40 years.

Table 1: Demographic characteristics of the patients

Age (Years)	18-30	31-40	41-50	51-60	61 & Above
Male (N=49) N (%)	18 (54.55)	14 (66.67)	9 (56.25)	5 (62.50)	3 (50.00)
Female (N=35) N (%)	15 (45.45)	7 (33.33)	7 (43.75)	3 (37.50)	3 (50.00)
Total (N=84) N (%)	33 (39.29)	21 (25.00)	16 (19.05)	8 (9.52)	6 (7.14)

The total number of males in the study was 49 (58.33%) and females were 35 (41.67%) (Table 2). Mean age of patients was 35.9 ± 13.64 years

Table 2: Gender wise distribution of the patients

Gender	N (%)	Mean Age \pm SD (years)
Male	49(58.33%)	35.62 ± 13.17
Female	35(41.67%)	36.45 ± 14.39
Total	84(100%)	35.97 ± 13.64

Post treatment Spirometric parameters between groups

Post treatment mean \pm SD of FEV₁% in group A was 72.3 ± 2.7 and in group B it was 72.7 ± 2.9 which showed that there was no significant difference in spirometric parameters between the two groups ($p=0.3734$).

Table 3: Showing the comparison of improvement in FEV₁ value in between groups

	FEV ₁ %	
	At end of therapy (mean \pm SD)	p value
Group A (Anti asthmatic treatment)	72.3 ± 2.7	0.3734
Group B (Anti asthmatic treatment + vitamin antioxidant trace elements supplementation)	72.7 ± 2.9	

Relation between vitamins, antioxidant, trace elements supplementation and pulmonary functions:

There was no significant improvement in FEV₁% between two groups ($p=0.3734$) which denotes that there was no additional benefit of giving vitamins, antioxidant and trace element supplementation on pulmonary functions and quality of life in asthmatic patients.

Quality of Life

Mini asthma quality of life questionnaire (mini AQLQ) for Asthma

Domains of health related to quality of life were expressed as four domains of the mini asthma quality of life questionnaire (mini AQLQ) containing 15 questions grouped under four domains – Symptoms, Activity limitation, Emotional function, Environmental stimuli. Mean score for each domain was calculated pre and post treatment. Total score was recorded as the average of the scores in 15 questions. For both the groups post treatment mean \pm SD value of MQLQ domains were compared shown in Table 4.

Table 4: Assessment of mini asthma quality of life questionnaire (MQLQ)

MQLQ Domains	Group A		Group B		P value
	Post (42)		Post (42)		
	Mean	SD	Mean	SD	
Symptoms (5 items)	5.86	0.72	5.94	0.75	0.4050
Activity Limitation (4 items)	5.98	0.65	6.18	0.62	0.2459
Emotional Function (3 items)	3.31	0.46	3.44	0.48	0.0541
Environmental Stimuli (3 items)	3.43	0.74	3.53	0.61	0.5271
Total Score	4.67	0.70	4.77	0.72	0.1141

Discussion

Asthma is a chronic disease associated with inflammation of airways and immuno-allergic abnormality. Studies from past has provided, substantial evidence regarding the role of oxidative stress in the pathogenesis of chronic diseases such as asthma. But its confirmatory role is yet to be established. Studies also suggest that concurrent administration of antioxidants along with the current pharmacological treatment can be beneficial in the long term symptomatic improvement of the disease process.

In our study, the age group for asthma ranged from 18 years and above. Maximum number of cases were in the age group 18-30 (39.47%) followed by 31-40 (25.44%). Majority (64.91%) of the patients were in the age group of 18-40 years. According to our study, mean age of 35.9 ± 13.64 years favors the fact that disease was common in economically productive age group compared to other ages. Similar finding was shown in study done by Nitant T et al,⁸ in Gujarat which showed age group of 13 – 64 years were more commonly affected with mean age of 39.8 years. However, finding in a study done by Micheal B et al,⁹ in Bengaluru, Karnataka showed 41-60 years as affected age group with mean age of 51.1 years.

Total number of males in the study was 49 (58.33%) which out-numbered female 35(41.27%). The results were comparable with other studies as in by More SR et al,¹⁰ in Maharashtra, showed that 54.5% were male and 45.5% were female. In a study by Arumugam V et al,¹¹ in Dehradun, 64% were males and 36% were females and in other studies by Puranik A et al,¹² MM Rafeeqet al,¹³ Basavaraju et al,¹⁴ Micheal B et al⁹ showed similar trend of gender

distribution. However, Rajathilagam T et al¹⁵ and Nitant T et al⁸ study showed female preponderance of the disease as compared to males. The reason for more males in our study may be attributed to more male to female ratio in Uttar Pradesh.¹⁶ Also, may be female patients are reluctant to utilize health care facilities unless they are critically ill.

In our study post treatment FEV₁% in group A was 72.3 ± 2.7 and in group B was 72.7 ± 2.9 which showed that there was no significant difference in spirometric parameters between the two groups ($p = 0.3734$). In a similar case-controlled study conducted by picado C et al,¹⁷ no association was found between bronchial asthma and the intake or the circulating levels of micronutrients or antioxidants. In contrast, cross sectional study by Ochs Balcom¹⁸ showed the association of antioxidant nutrients and markers of oxidative stress with forced expiratory volume in the first second (FEV₁%). The study data included 218 persons with chronic airflow limitation showed that serum beta-cryptoxanthin, lutein/zeaxanthin, and retinol, and dietary beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin, Vitamin C and lycopene were positively associated with FEV₁% ($P < 0.05$).

The quality of life was analyzed using Mini asthma quality of life questionnaire (mini AQLQ) in asthma patients and it was found that total mean score post treatment in group A and B were 4.67 ± 0.70 and 4.77 ± 0.72 respectively. In our study statistically insignificant difference was found in the average total score post treatment ($p = 0.1141$). This signifies that addition of vitamin, antioxidant and trace element supplementation does not improve the quality of life of asthma patient. When compared between the various

domains of mini AQLQ, mean score for individual domains also showed insignificant improvement post treatment.

Conclusion

In conclusion, we have not found any significant improvement by vitamin, antioxidant, trace element supplementation on pulmonary functions and quality of life in asthma patients.

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Conflict of Interest

None.

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