

## ORIGINAL ARTICLE

# Serum IgE Level among Coir Workers with Asthma: A Hospital Based Descriptive Study from Alappuzha, Kerala

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## Abstract

**Background:** Coir industry provides a major share of occupation to the natives of Alappuzha district of Kerala State, South India. A significant proportion of workers in this industry have been found to have nasobronchial symptoms. A pilot study conducted in our institute, among coir workers revealed that more than 35% of coir workers suffered from nasobronchial allergy and it is directly proportional the years spent in the work field. This study was conducted to find out whether coir worker's asthma is immunologically mediated or not and also to find out the difference if any in the Ig E level between males and females with coir workers asthma.

**Methods:** The study was done as a descriptive study. Coir workers with symptoms suggestive of asthma who attended the outpatient clinic of Government TD Medical College Hospital Alappuzha during 2005-2006 were included in the study. Detailed occupational history was taken using a semi structured interview schedule. Symptom profile of the patients were assessed in detail followed by clinical examination and spirometry. The serum Ig E level was estimated by ELISA technique. Data were entered in MS Excel and statistical analysis was performed with Mann-Whitney U test using SPSS version 16. P value < 0.05 was taken as the cut off point for statistical significance.

**Results:** The total number of patients included in the study was 62 out of which 25 were males and 37 were females. (Mean age: 36 years, Males: 33 years and Females: 38 years). All except one patient showed latent period before developing asthmatic symptoms and it varied from 6 months to 44 years, with a mean of 9.9 years. The latency period was considerably more in males. 56 patients (91%) had elevated total serum IgE (mean of 1311 IU). Male patients had a considerably higher value of serum Ig E.

**Conclusions:** The serum IgE levels were found to be higher in coir workers with asthmatic symptoms and hence it is reasonable to believe that coir workers asthma is of largely immunological in origin.

commercially important natural fiber. It is a product from the coconut tree (*Cocos nucifera*). The husk of coconut, which is a mass of packed fibers, can be woven into strong twine or rope, and is used for padding mattresses, upholstery, etc. Coir industry is a predominant industry in many parts of southern Kerala, especially Alappuzha. A vast majority of 6 lakh workers involved in the coir industry in Kerala are from the district of Alappuzha. Among them more than 50% are females.

The coir industry involves two types of work - domestic & factory. Domestic work involves soaking of coconut husk for weeks in water, crushing and beating in to fibers. Mainly female laborers do this. The coconut husks are soaked in pools dug for the purpose. It can take months for the husks to soften enough to be workable. The husks are then beaten into fibers and which are then laid out in the sun to dry. They are then spun into ropes. Some of the women in the villages spin the coir by hand. Some use equipments similar to a spinning wheel called "rads" for spinning fibers into ropes. The ropes are then taken to a weaver to be woven on large, outdoor looms into mats. Factory work includes decolourisation of fibers using chemicals (Sulphur dioxide & Chlorine), dyeing of fibers and weaving into coir and mats. Males are more often employed in this work.

A significant proportion of workers in this industry have been found to have nasobronchial symptoms. A pilot study conducted in our institute, among coir workers revealed that more than 35% of coir workers suffered from nasobronchial allergy.<sup>2</sup> Subsequently spirometry were done among 624 symptomatic coir

## Introduction

Occupational Asthma (OA) is defined as a disease characterized by airway inflammation, variable airflow limitation, and airway hyper responsiveness due to causes and conditions attributable to a particular occupational environment and not to stimuli encountered outside the workplace.<sup>1</sup> This type of work-related asthma should be more accurately labeled as "Occupation-induced asthma" to emphasize the determining causal link between asthma and the workplace. True OA has to be

differentiated from Work-aggravated asthma which is defined as pre-existing or concurrent asthma that is exacerbated by workplace exposures. Work related asthma is the terminology often used to describe these groups together or when a particular case is not well categorized by causal link.

Coir industry provides a major share of occupation to the natives of Alappuzha district. Coir is a

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**Table 1: Diagnostic criteria of occupational asthma: ACCP guideline****Diagnostic criteria**

- A. Diagnosis of asthma
- B. Onset of symptoms after entering the workplace
- C. Association between symptoms of asthma and work
- D. One or more of the following criteria
  1. Workplace exposure to an agent or process known to give rise to occupational asthma
  2. Significant work-related changes in FEV<sub>1</sub> or peak expiratory flow rate
  3. Significant work-related changes in nonspecific airway responsiveness
  4. Positive response to specific inhalation challenge tests with an agent to which the patient is exposed at work
  5. Onset of asthma with a clear association with a symptomatic exposure to an irritant agent in the workplace (reactive airways dysfunction syndrome)

workers with nasal and bronchial symptoms. Functional abnormality is predominantly obstruction with significant reversibility.<sup>3</sup> Small airway obstruction is noticed in more than 65% of patients. Reduction in pulmonary function is directly proportional to the duration of work.

One of the most important issues we addressed was whether the asthma like symptoms seen in coir workers is really occupational asthma or not. Many a time diagnosing occupational asthma with certainty is a challenging task for the physicians. The criteria proposed by the American College of Chest Physicians (ACCP) for defining occupational asthma<sup>4</sup> is given in Table 1.

In our study, we have excluded all patients with allergic symptoms prior to working in coir industry. In most of these coir workers with asthma, the causal relationship between workplace exposure and symptoms are clear. They were asymptomatic prior to entry into the work.

Moreover, they are relatively symptom free on off-work days. So, according to these criteria, asthmatic symptoms in coir workers can be categorized as OA with certainty.

Immunologically occupational asthma can be divided in to two major groups<sup>5</sup>. One is allergic which is induced by sensitizers and this type usually appears after a latent period necessary for the person to acquire sensitization to the causal agent(s). This is the most common form of OA accounting to more than 90% of cases. The next one is the irritant induced

OA or non-immunologic/ non-allergic OA. This form is characterized by the development of asthma or the reactivation of quiescent asthma caused by the exposure to irritant substances at the workplace that is capable of inducing acute inflammation and non-specific bronchial hyper responsiveness in the airways through various non-sensitizing mechanisms.

Immunoglobulin E (IgE) discovered in 1966-67 by two independent groups of researchers holds a peculiar status among the class of immunoglobulins. It is present only in mammals and is normally present in human serum in extremely small amounts; its serum concentration may increase several hundred-fold in response to specific stimuli. Since its discovery IgE has been used in studies among various patient groups and populations. The immunologic response of individuals exposed to similar environments is not uniform and a wide range of serum IgE levels has been reported among people of different ages.<sup>6</sup> The levels are increased in allergic diseases like allergic rhinitis, allergic asthma and atopic dermatitis or urticaria.

For agents that act through an IgE mediated mechanism, skin testing or serologic measurement of specific IgE antibodies can be used to assess sensitization. The workers exposed to chemicals and other substances may develop sensitization with elevated serum IgE levels. Hence estimation of serum IgE would be appropriate in suspected allergic and hyper responsive conditions by sensitive, rapid and accurate methods. In this back ground we planned to investigate whether Coir workers asthma, a major occupational lung disease affecting the population is immunological in origin or not, using serum IgE as a surrogate marker.

**Objectives**

1. To find out whether coir worker's asthma is immunologically mediated or not.
2. To find out the difference if any in the serum IgE levels between males and females with coir workers asthma.

**Materials and Methods**

All the data in this study were collected during the hospital visit of the study population. It was done as a descriptive study.

**Inclusion criteria**

Coir workers with symptoms suggestive of asthma who attended the outpatient clinic of Government TD Medical College Hospital Alappuzha from 2005-2006 were included in the study.

**Exclusion criteria**

Smokers, patients with other respiratory diseases like bronchiectasis, pleural disease, active or healed pulmonary tuberculosis and lung malignancy and patients with respiratory symptoms prior to working in coir industry were excluded from the study. Patients with a past or family history of atopic asthma were also excluded.

**Methodology**

Detailed occupational history was taken using a semi structured interview schedule. The questionnaire include the type of work, duration, years since involved in the particular work, any exposure to chemicals or other known factors, details regarding periodic health examination, history of previous jobs, history of change of jobs and whether co workers are affected with similar symptoms or not. The symptom profile of the patients like history of wheezing, chest tightness, breathlessness, irritation of eyes, nose, features suggestive of urticaria etc were obtained in detail, clinical examination and spirometry including bronchodilator response were conducted. The latency period (from the initiation of work in the coir industry to the appearance of asthmatic symptoms) if any was assessed in all patients. Total serum IgE was estimated in all patients by fully automated Bi-directional Interfaced Chemo luminescent immunoassay method to assess sensitization. Data were entered in MS Excel and statistical analysis was performed with Mann-Whitney U test using SPSS version 16. P value < 0.05 was taken as the cut off point for statistical significance.

**Results**

No. of Coir Workers	: 62
Males	: 25
Females	: 37
Mean age of the patients	: 36
Mean age of Males	: 33

**Table 2: Normal reference range of serum Ig E (One IU is equal to 2.4 nano gram)**

Age in years	Serum total Ig E (IU/mL)
<1	0-15
1-5	0-60
6-9	0-90
10-15	0-200
Adults	0-200

Mean age of Females : 38

Among the 62 coir workers with OA, all except one had a latent period. The latency period varied from 6 months to 44 years, with a mean of 9.9 years. The latency period was considerably more in males with a mean of 12.5 years while in women the mean latent period was 8.25 years (Table 3). This is an interesting finding and we searched for any data on gender difference in latent period for the development of occupational asthma. No data on this was obtained despite extensive literature search. However, the difference in the latent period observed in our study was not found to be statistically significant (Mann-Whitney U test - U value 377, Z score - (-1.21), p value 0.22. The result is not significant at  $p < 0.05$ ).

Serum IgE was estimated in all patients. The normal reference values for Ig E is given in Table 2. Fifty six out of sixty two patients in our study (91%) had a value above the upper limit of normal. (mean of 1311 IU/mL). Male patients had a considerably higher value (mean 1869 IU/mL) compared to females (mean 996 IU/mL). This difference was found to be statistically significant (Mann-Whitney U test - U value 305.5, Z score - (-2.21), p value 0.026. The result is significant at  $p < 0.05$ ). Several studies have shown that mean serum Ig E level is more in men than women of same age.<sup>7,8</sup>

## Discussion

Occupational asthma exist in two major types - "immunological" as well as "nonimmunological" asthma.<sup>9</sup> Immunological OA is characterized by a latency period necessary to acquire immunologically induced sensitization and the total and specific serum IgE of such patients will be elevated.<sup>10</sup> Nonimmunological OA is characterized by the rapid onset of asthma symptoms following single or multiple exposures to high concentrations of irritant compounds.

**Table 3: Latent period in developing asthma, serum Ig E level and gender differences**

Gender	Number	Mean age	Mean latency period in years	Mean serum IgE
Male	25	33	12.5	1869
Female	37	38	8.25	953

In this setting, this study was conducted to find out whether coir worker's asthma is immunologically mediated or not. Among the 62 coir workers with symptoms suggestive of nasobronchial allergy and reversible obstruction in spirometry, all except one had a latent period (mean of 9.9 years) and 56 patients (91%) had elevated total serum IgE (mean of 1311 IU). This leads to the conclusion that coir worker's asthma is of immunological origin.

### Strengths and limitations of the study

Our study includes a representative study sample on which comparisons to be made on Ig E levels between men and women and the difference in terms of sensitization could also be assessed. The patients participated in this study were representative of the working population in the coir industry, though the data is hospital based and the number of patients were less in number. This is the first and only study that quantified the serum Ig E level among coir workers with asthmatic symptoms.

However, we could not elucidate the exact pathogenesis and cause-effect relation of the coir occupation to the asthma like symptoms among the coir workers. The possible factors suspected include allergic reaction to one of the organic components of the coir dust. The presence of allergic nasal symptoms and the development of asthmatic symptoms later support the theory of allergic origin. Allergic or hypersensitivity reaction to a possible fungal element in the moist dusty atmosphere could also be considered in the etiology. Non-allergic bronchial hyper-reactivity following exposure to chemicals and particulate dust is also a possibility. Sulphur dioxide used in this industry for bleaching of coir fibers possibly have some adverse effects on pulmonary functions. Poor working condition also may contribute to the symptoms.

We also could not explain the reason for the observed gender differences in the prevalence of Coir workers asthma.

It may probably due to the difference in sensitization (for which also we do not have any convincing answer) and also be due to the fact that men and women even though working in the same environment are usually carrying out different tasks.

### Conclusion

We thus conclude that there is high burden of naso bronchial symptoms and asthma of occupational origin among the coir workers of Alappuzha district of Kerala. The serum IgE levels were found to be higher in coir workers and hence it is reasonable to believe that coir workers asthma is of largely immunological in origin. Appropriate preventive measures to reduce/prevent exposure during various stages of coir making process are advised to reduce sensitization.

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