

# Nasobronchial Allergy and Pulmonary Function Abnormalities Among Coir Workers of Alappuzha

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## Abstract

**Background:** Coir is a commercially important natural fiber obtained from the coconut husk. Coir can be woven into strong twine or rope, and is used for padding mattresses, upholstery, etc. Coir industry provides a major share of occupation to the natives of Alappuzha district of Kerala State. It has been noticed earlier that there is increased incidence of nasobronchial allergy among the population involved in this industry.

**Objectives:** This study was aimed at recognizing the symptomatology and pulmonary functional impairment among symptomatic coir workers.

**Design:** All coir workers who attended our institute over a period of three years were included in the study. Detailed occupational history was taken; symptom profile was studied in detail, clinical examination and pulmonary function tests conducted.

**Results:** Among the 624 symptomatic coir workers selected for this purpose, 64 patients had purely nasal symptoms, while 560 had symptoms of nasobronchial allergy. 357 patients had reversible obstruction on PFT, while 121 had only small airway obstruction.

**Conclusions:** We conclude that coir work induced nasobronchial allergy and pulmonary function abnormalities. In absence of CT scan and bronchial challenge testing it may be inappropriate to label coir work as occupational hazard. However the present study may be used as thought provoking study to initiate further understanding.

## Introduction

Coir is a commercially important natural fiber. It is a product from the coconut tree (*Cocos nucifera*). Coconut, the fruit of coconut tree has a husk, which is a mass of packed fibers called coir, which can be woven into strong twine or rope, and is used for padding mattresses, upholstery, etc. Coir industry provides a major share of occupation to the natives of Alappuzha district of Kerala State. A significant proportion of workers in this industry have been found to have nasobronchial symptoms.<sup>1</sup> This is a pilot study (descriptive in nature) conducted in our institute, a tertiary center with the following objectives.

- To study the clinical profile of coir workers with nasobronchial symptoms.
- To assess the pulmonary function abnormalities in such patients.
- To correlate the duration of work and onset of symptoms.
- To study the effect of exposure to chemicals on the severity of symptoms.

## Materials and Methods

### Study Subjects

This study was conducted in Alappuzha, a coastal district of southern Kerala, South India. All coir workers who attended the Allergy clinic of our institute over a period of three years

were included in the study. All subjects gave written informed consent. The Ethics Committee of TD Medical College approved 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

All participants answered a questionnaire, which included questions about respiratory symptoms, living conditions, active and passive smoking, and details about their occupational background.

### Medical and Occupational History

Detailed occupational history was taken in all patients. The coir industry involves two types of work - domestic and 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 and Chlorine), dyeing of fibers and weaving into coir and mats. Males are more often employed in this work.

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**Table 1 : Symptoms in relation to nature of work**  
[Data are presented as No.(%)]

	Nasal symptoms alone	Cough and wheeze	Combined
Domestic (n = 449)	43	250	156
Factory (n = 175)	21	37	117

**Table 2 : Symptoms in relation to exposure to chemicals**  
[Data are presented as No.(%)]

	Nasal symptoms alone	Cough and wheeze	Combined
Exposed to chemicals (n = 193)	24	78	91
Not exposed to chemicals (n = 431)	40	209	182

**Table 3 : Pulmonary Function Study**  
[Data are presented as No.(%)]

Function	No. of Patients
Near normal	42 (7%)
Reversible obstruction	357 (57%)
Irreversible obstruction	37 (6%)
Mixed defect	67 (11%)
Small airway dysfunction only	121 (19%)

The symptom profile of all patients were also studied in detail and clinical examination conducted. Investigations like routine blood tests, X-ray chest, and pulmonary function tests including reversibility were assessed in all patients.

#### Lung Function

Pulmonary function testing was performed by trained technicians using a spirometer (model Microquark, PFT suite version 7.5a, Cosmed Ltd) and testing techniques that followed American Thoracic Society recommendations.<sup>2</sup> The following parameters were recorded: FEV<sub>1</sub>, FVC, FEV<sub>1</sub>/FVC ratio, and forced expiratory flow between 25% and 75% of FVC (FEF<sub>25-75%</sub>), before and 15 minutes after inhalation of two puffs of salbutamol. Percentage of predicted values for FEV<sub>1</sub>, FVC, FEV<sub>1</sub>/FVC ratio, and FEF<sub>25-75%</sub> were obtained from equations developed by Crapo et al.<sup>3</sup> The higher of two values for FEV<sub>1</sub> repeatable to within 100 mL were recorded, and the percentage of predicted values was calculated. Reversibility was defined as either an increase in FEV<sub>1</sub> by 12% or more and absolute value at least by 200ml or more, after an inhalation of salbutamol.

#### Statistical Analysis

Continuous variables were described with means. Standard error of difference between proportions and means (t test) were applied at appropriate contents.

## Results

A total number of 624 subjects were involved in the study - 168 (27%) males and 456 (73%) females. The majority are women because of exclusion of smokers.

#### Nature of Work

- Domestic work : 449 (72%)
- Factory work : 175 (28%)

#### Exposure to chemicals and dyes

- Exposed to chemicals and dyes : 193 (31%)
- Not exposed to chemicals and dyes : 431 (69%)

**Table 4 : Relationship between duration and severity of the disease**  
[Data are presented as No.(%) or mean]

Duration of work (yrs)	No. of pts.	Average FEV1 (% pred)	Average FEF 25-75 (% pred)
1-5	131	73.5	88
6-10	88	66.6	60.4
11-15	56	64.4	65
16-20	105	60	72
21-25	50	53.3	60
26-30	75	47.7	66.7
>35	119	34	58

**Table 5 : Exposure to chemicals and severity of disease**  
[Data are presented as No.(%) and mean]

Nature of work	No. of patients	Average FEV1 (% pred)	Average PEFr (L/mt)	Interval between exposure and onset of disease	P value
Exposed to chemicals	193	56.4	254	7.3 years	<0.01
Not exposed	432	70.6	318	15 years	<0.01

Even though usually chemicals and coloring agents are used only in the factory, occasionally, domestic works also involve them.

#### Symptom Profile

- Nasal symptoms alone : 64 (10%)
- Cough and wheeze : 287 (46%)
- Combined : 273 (44%)

Reduced FEV<sub>1</sub>/FVC suggestive of airway obstruction was observed in 57% of the patients. Reduced FEF 25-75 alone was observed in 19%.

#### Mean latency period

The mean latency period for development of allergic rhinitis was 3.5 years; while for asthma it was 13 years.

It is evident that as the duration of exposure to coir dust increases, the severity of symptoms and the extent of functional impairment worsen. All the 37 patients who had irreversible airway obstruction belonged to the group with more than 30 years of exposure.

Peripheral eosinophilia was detected in 33% of the patients. X-Ray chest were normal in majority (62%), while hyperinflation was noticed in 31 patients, increased lung markings in 65, findings suggestive of Allergic Broncho Pulmonary Aspergillosis in 4 patients.

## Discussion

Coir industry is a predominant industry in many parts of southern Kerala, especially Alappuzha. It has been noticed earlier that there is increased incidence of nasobronchial allergy among the population involved in this industry. Huge amount of dust is generated during various stages of coir manufacture. Various chemicals are also used. This is in contrast to the only published study among coir workers conducted by Uragoda CG, involving 779 workers who processed coir in Colombo; which states that coir dust was inert and therefore not harmful to man.<sup>4</sup>

But our study indicates that coir dust can evoke allergic symptoms and pulmonary function abnormalities. Since we excluded smokers, atopic individuals and preexisting nasobronchial allergy, the symptoms among these large numbers

of patients cannot be explained by any other means.

Pulmonary function defect in the majority of patients included a reversible airway obstruction with predominant small airway obstruction. Even though the disease cannot be labeled as occupational asthma without further investigations like challenge testing, the occurrence of rhinitis and asthmatic symptoms even in non-atopic individuals suggest so. The exact pathogenesis and cause-effect relation of the occupation to the disease has to be studied further. However the possible factors are:

- Allergic reaction to one of the organic components of the coir dust. The presence of allergic nasal symptoms and the sequential emergence of asthmatic symptoms later support this theory of allergic origin.
- Allergic or hypersensitivity reaction to a possible fungal element in the moist dusty atmosphere.
- Non-allergic bronchial hyper-reactivity following exposure to chemicals and particulate dust. Sulphur dioxide which is being used in this industry for bleaching of coir fibres might have implications on pulmonary functions.<sup>5</sup>

Poor working condition also may contribute to the symptoms.

## Conclusion

Combined nasal and bronchial symptoms are noticed among majority of symptomatic coir workers of Alappuzha. Functional abnormality is predominantly obstruction with significant

reversibility. Reduction in pulmonary function is directly proportional to the duration of work. Exposure to chemicals hastens the disease process and increases the severity of disease. The nasobronchial symptoms in coir industry may be considered as an occupational hazard. Even though, in absence of bronchial challenge testing, it may be inappropriate to label coir work as occupational hazard, the present study may be used as thought provoking study to initiate further understanding.

## Acknowledgements

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