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Studies on asthma and allergic rhinitis among occupational hazardous workers in and around Pollachi

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ABSTRACT

Between 200 to 300 Million people around the globe suffer from Asthma and Allergic Rhinitis and the number is increasing. India has an estimated 15 to 20 million asthmatics, with a prevalence rate of 10 and 15 percent. In order to find out the prevalence rate of allergic diseases among occupational hazardous workers in and around Pollachi, an epidemiological study is conducted in industrial areas Surya Spinning Mill and Shri Dharma Shastha Coir Industry along with Dr.K.Sivanandhan. Blood samples are collected and analyzed using IgE ELISA kit. A total of 113 workers, Surya Spinning Mill 94, Shri Dharma Shastha Coir Industry 19 are examined clinically, data are collected using a questionnaire and blood samples are collected and analyzed and tabulated. It is found out that prevalence rate of Asthma and Allergic rhinitis in Surya Spinning Mill is 12.7% and in the Coir Industry it is 15.8 percent. The results showed that the prevalence rate of Asthma and Allergic Rhinitis are within 10 to 12 percent as in the case of urban and rural area. From the above study it is also proved that just exposure to dust or smoke or coconut husk alone will not cause Bronchial Asthma or Allergic Rhinitis.

Keywords: Bronchial Asthma, Allergic Rhinitis, IgE ELISA kit, Prevalence Rate, Immunoglobulin E.

INTRODUCTION

“Asthma is a complex disorder involving a combination of genetic and environmental interactions that lead to airway inflammation characterized by T – helper – 2 cell polarization and airway wall remodeling accompanied by extensive epithelial dysfunction”¹.

Allergen exposure is the single most powerful environmental risk factor for asthma. Recently there has been an increase in morbidity associated with asthma and there is strong evidence that asthma and allergic disorders are increasing in prevalence and severity.

Hence, “asthma” is a complex genetic disorder, expression is influenced by the interaction between genetic and environmental factors.

Genetic susceptibility for asthma, atopy, BHR Genetic heterogeneity, Penetrance, phenocopy	+	Allergens, air pollutants Viral infections = changes in seasons, age	=	Clinical Asthma (Reversible and irreversible in airway structure function)
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Unless there is genetic susceptibility for asthma, atopy, allergens like air pollutants, smoke, viral infections, seasonal changes etc cannot cause asthma or atopic disorders. In order to prove this factor by laboratory analysis, we have taken up epidemiological survey among workers, working in Spinning Mills, coconut husk mills etc.

It has been internationally accepted that prevalence and severity of allergic diseases including Asthma, have increased over the last 30 years.² The average incidence rate is 10 to 15%. The health cause of Asthma increase with age in UK and approach over £ 1 billion per Annum.

The association between Air Pollution exposure due to industrialization and occurrence of allergic disorder like Bronchial Asthma has been recognized. Since the early part of this century, various epidemiological study has been conducted in various parts of the world like Germany, Portuguese, Belgium, China, Japan etc.

The study showed slight increase in occurrence rate in area with high air pollution but epidemiological study in other area like residential, sub urban area also showed more or less same level of occurrence.

So in order to find out the actual occurrence rate of Asthma and Allergic Rhinitis in industrial area, and an epidemiological study among occupational hazardous workers in and around Pollachi has been conducted by myself along with the collaboration of Dr. K. Sivanandhan.

We have selected two industrial areas posing environmental risk factor for Asthma.

1. Surya Spinning Mill situated on the eastern outskirts of Pollachi.
2. Sri Dharma Shastha Coir Industry, also situated in the eastern outskirts of Pollachi.

Totally 113 workers from industrial were examined to find out whether they suffer from Bronchial Asthma and Allergic rhinitis. Questionnaires were filled up and blood samples were collected.

MATERIALS AND METHODS

Collection of sample

Blood samples are collected on October 2011 by vein puncture, allowed to clot and separated the serum by centrifugation at room temperature. If sera cannot be assayed immediately, they will be stored at 2-8⁰C for a week. Avoided repeated freezing and thawing of serum sample.

Principle of the assay

The MAGIWEL IgE (Merck) quantitative is a solid phase enzyme-linked immunosorbent assay (ELISA). The wells are coated with anti- IgE antibodies. The samples, standards and controls are incubated in the wells with enzyme conjugate which is another antibody directed toward a different region of IgE molecules and chemically conjugated with horseradish peroxidase. Unbound enzyme conjugate is washed off and the amount of bound peroxidase is proportional to the concentration of the IgE present in the samples, standards and controls. Upon addition of the substrate and chromogen, the intensity of colour developed is proportional to the concentration of IgE in the serum

Assay procedure and conditions

All the samples and reagents are kept in a room temperature (24-30⁰C), used new disposable tips for each specimen. Secure the desired number of coated wells in the holder. Dispensed 10uL of standards, controls or serum samples into appropriate wells, immediately added 100uL of UBI zero standard diluents into each well, then incubate for 30 minutes at room temperature. Removed incubation mixture and rinsed the wells 5 times with tap water(300uL)and the water thoroughly, dispensed 100uL of enzyme conjugate to each well and incubated 30 minutes; Removed the incubation mixture and rinsed with water five times. Dispense 100uL of solution A and then 100uL of solution B into each well and incubated for 10 minutes in room temperature. Added 50uL of stop solution and stopped the reaction and read O.D at 450 nm with a micro well reader

Washed the micro wells and removed water thoroughly. Pipetted all reagents and samples into the bottom of wells and avoided scratching the well. Vortex-mixing or shaking of wells is not required. Absorbance is a function of time and temperature of incubations. We kept reagents, samples and needed wells ready and assigned. It ensured the equal elapsed time for each Pipetting without interruption. For the same reason, the size of the assay run each time is also limited. It is suggested to run no more than 20 patients with a set of reference standards in duplicate.

Calculation

Microwell reader capable of determining at 450 nm is used. The IgE value of patient is obtained as follows:

Plotted the concentration (X) of reference standard against absorbance (Y) on full logarithmic paper.

Obtained the value of patient IgE by reference to the standard curve.

Expected value

Serum IgE may vary as a result of season of that geographical location, diet and the year. It is recommended that laboratory should establish expected normal range. Study of the expected concentration of IgE in a population of healthy non allergic individuals are complicated by the fact that some individuals may have sub-clinical allergies, and have abnormal IgE concentration.

The geometric mean IgE values for healthy children have been reported to be age dependent and peak (28IU/mL) at the range of 10 years. For non atopic adults, the geometric mean IgE value was reported to be 14 IU/mL

TOTAL IgE

Normal range			
Age	Value	Age	Value
<1yr	<29.0	2-3yr	<45.0
1-2yr	<49.0	3-9yr	<52.0
		Adults	<87.0

Analytical sensitivity : 1.0IU/mL

Calibration range : upto 2000 IU/mL

Specimen required : 2mL random serum sample

RESULTS

INDUSTRIAL AREA SURIYA SPINNING MILL

Out of 94 workers examined 51 are females and 43 are males. 36 workers are working for less than 1 year in the mill. 21 persons are working for 1 to 5 years; 15 persons for 6 to 10 years; 14 persons between 11 to 20 years and 8 persons for more than 20 years.

71 workers are from rural area and 23 from semi-urban area.

Among 94 workers, 47 persons (50%) are having normal level of (Below 100 IU/ml) Immunoglobulin E (IgE); 22 workers having IgE level between 100 to 150 IU/mL (23.5%) 12 workers (12.7%) are having IgE level between 151 to 300 IU/mL; 4 workers (4.2%) between 301 to 500 IU/mL and 9 workers (9.6%) are having IgE level above 500 IU/mL.

EPIDEMIOLOGICAL SURVEY FOR ALLERGIC DISORDERS AMONG WORKERS OF SURYA SPINNING MILLS, POLLACHI

S.No.	Age	Sex	Year of Working	Eosinophil Count	IgE Estimation
01.	39	F	10 yrs	100	104
02.	28	F	2 yrs	120	82
03.	19	F	1 yr	90	600
04.	18	F	1 yr	70	102
05.	39	M	2 yrs	80	398
06.	19	F	1 yr	65	102
07.	51	M	4 months	80	50
08.	29	M	2 yrs	180	89
09.	45	M	1 yr	20	105
10.	27	M	6 months	210	32
11.	34	M	2 yrs	100	98
12.	34	F	2 yrs	240	80
13.	47	F	12 yrs	140	590
14.	45	F	1 yr	240	108
15.	50	F	6 months	220	221
16.	36	M	9 months	60	268
17.	26	F	3 months	78	98
18.	29	F	6 months	20	60
19.	38	M	1 yr		
20.	38	M	1 yr	180	120
21.	37	M	15 yrs	210	192
22.	28	F	6 months	210	84
23.	29	F	6 months	75	106
24.	28	F	1 yr	30	75
25.	30	F	6 yrs	64	351

26	35	F	6 months	210	96
27	40	F	5 yrs	240	826
28	34	M	1 yr	160	150
29	32	F	6 months	180	120
30	28	F	10 months	120	98
31	34	F	2 months	70	86
32	18	F	4 months	20	32
33	33	M	3 yrs	240	152
34	28	M	10 yrs	560	462
35	32	M	4 yrs	180	583
36	32	F	3 months	190	94
37	38	F	20 yrs	240	108
38	25	M	8 months	240	90
39	38	F	5 yrs 3 m	110	82
40	32	F	1 yr	130	30
41	36	F	13 yrs	220	180
42	32	F	12 yrs	70	292
43	23	F	15 yrs	110	852
44	39	F	6 months	52	65
45		F	6 months	52	80
46	25	F	6 months	45	70
47	27	F	10 yrs.3 m	60	190
48	20	F	2 months	180	80
49	45	F	1 yr	189	94
50	24	F	3 yrs	100	118
51	36	F	3 months	85	98
52	25	F	6 yrs	204	160
53	17	F	1 yr	220	20
54	29	M	15 yrs	290	211
55	36	F	7 yrs	65	89
56	18	F	3 months	90	100
57	34	M	10 yrs	75	158
58	54	M	27 yrs	472	149
59	47	M	26 yrs	54	152
60	35	M	21 yrs	165	98
61	55	F	10 yrs	106	120
62	42	M	10 yrs	62	88
63	29	F	1 yr	204	102
64	50	M	28 yrs	225	107
65	34	F	10yrs	45	90
66	29	F	5 yrs	250	120
67	42	M	25 yrs	420	104
68	52	M	15 yrs	100	80
69	35	M	10 yrs	136	98
70	30	M	3 yrs	72	921
71	62	M	15 yrs	120	90
72	31	F	8 yrs	256	88
73	45	M	6 months		40
74	42	F	16 yrs	100	98
75	42	M	9 yrs	189	90
76	38	F	1 month	71	70
77	21	F	2 months	160	80
78	42	F	1 month	120	50
79	37	M	12 yrs	225	150
80	39	M	19 yrs	360	130
81	47	M	8 yrs	560	920
82	35	M	15 yrs	80	90
83	55	M	3 months	576	45
84	73	M	5 yrs	996	78
85		F	5 yrs	140	85
86	49	M	28 yrs	58	90
87	22	M	6 yrs	45	98
88	52	M	20 yrs	120	1050
89	30	M	4 months	80	60
90	59	M	25 yrs	96	130
91	40	M	4 yrs	260	169
92	41	M	22 yrs	183	183
93	55	M	7 months	55	80
94	28	M	5 yrs	80	92

Out of 94 Workers, 12 persons are suffering from overt signs and symptoms of either Bronchial Asthma and Allergic Rhinitis.

S.No.	Age(Yrs.)	Gender	Years of Working	IgE Estimation	Eosinophil Count
1.	19	F	1 Yr.	600	90
2.	39	M	2 Yrs.	398	80
3.	47	F	12 Yrs.	590	140
4.	36	M	12 Yrs.	268	60
5.	37	M	9 Months	192	210
6.	40	F	15 Yrs.	826	240
7.	23	F	5 Yrs.	852	110
8.	30	F	3 Yrs.	921	72
9.	37	M	12 Yrs.	150	225
10.	47	M	8 Yrs.	920	560
11.	52	M	20 Yrs.	1050	120
12.	55	M	7 Months	80	55

Among 12 persons, who are suffering from allergic disorders 3 (3.2%) workers are suffering from allergic manifestations even before joining Mill. Only 9 (9.6%) persons started having either bronchial asthma and allergic rhinitis after joining the mill. So the prevalence rate among 94 workers is 12.7%. In Dharma Shastha industry out of 19 workers working in the mill only 3 workers are affected (15.8%)

If exposure to the dust or smoke or coconut husk will be the cause of allergic diseases such as Bronchial asthma and allergic rhinitis, then all the workers must be affected; but the study shows only 10 to 15% of the workers are affected. Hence what factor give protection to the 80% to 85% of workers or people, who are not affected, has to be answered.

INDUSTRIAL AREA SRI DHARMA SHASTHA COIR INDUSTRY

Among 19 workers, 10 are males and 9 are females. All the 19 workers are from rural area only. 2 persons are working for less than 1 years. 3 persons are working between 2 to 5 years; 4 persons between 6 to 10 years and 8 persons between 11 to 20 years. 2 persons are working for more than 20 years.

SRI DHARMA SHASTHA COIR INDUSTRY, POLLACHI

S.No.	Age(Yrs.)	Gender	Years of Working	IgE Estimation	Eosinophil Count
1.	67	M	15	87	265
2.	50	F	30	89	128
3.	38	M	16	28	70
4.	41	M	1	84	272
5.	43	M	11	53	58
6.	28	F	5	43	975
7.	35	F	5	68	248
8.	70	M	11	26	110
9.	43	F	9	87	180
10.	35	M	10	102	183
11.	40	M	5	72	305
12.	51	F	20	22	192
13.	32	M	8	167	476
14.	40	F	20	226	195
15.	47	M	20	97	72
16.	79	M	30	128	140
17.	28	F	1	278	236
18.	40	F	2	263	372
19.	35	F	11	39	360

Out of 19 workers, 9 are born as first child to their parents. Three persons are having allergic manifestations (Bronchial asthma – 2 and allergic rhinitis one) One worker aged about 67 years, working in the mill for more than 15 years, is having bronchial asthma for the last 3 months another worker aged about 79 years, a chronic smoker, is working in the mill for the last 30 years; but he is having bronchial asthma for the last 60 years. Hence, the bronchial asthma is not related to fibre dust. His serum IgE level (only 87 IU/ml) is not raised. One persons is having sneezing complaints for the last one month; her serum IgE level is not raised; but there is slight increase in absolute eosinophil count (975 cells)

Among 9 workers who are born as first child, 2 persons are having allergic manifestations. 5 workers are having family history of Bronchial asthma and / or allergic rhinitis. None of the worker is having overt allergic manifestations.

As for as serum immunoglobulin E level is concerned, five persons are having elevated IgE level ie. more than 100 IU / ML. Among the five persons, only one persons is having overt bronchial asthma manifestations; the remaining four persons are having only elevated serum Ig E level without showing allergic manifestations. Whether the fibre dust caused the rise in serum IgE is a controversial factor since two workers are working for one and two years and another 2 workers for more than 8 and 20 years. Both workers are born as first child; but no family history of allergic manifestations.

Hence only 3 persons (2 persons – Bronchial Asthma and one person from Allergic rhinitis) are showing allergic manifestations which are not related to fibre dust exposure and the prevalence rate is 15.8 % which is as in the case of other rural and urban areas.

DISCUSSION

The rising trend in cases of Asthma is paralleled by co-ordinated efforts to identify the causes of this worldwide epidemic. It is unclear when the epidemic started. A pattern of geographical distribution began to emerge from international cross sectional studies such as the European Community Respiratory Health Survey (ECRHS)³ and the International Study on Asthma and Allergies in Childhood (ISAAC). The association between air pollution and respiratory morbidity and mortality has been recognized since the early part of this century. It is because of proliferation in the number of cars, Sulphur Di-oxide (SO₂)⁴ smoke from burning coal, photochemical pollutants due to combustion of petrol and diesel. The principal pollutants are NO₂,⁵ Ozone⁶ and particulates⁷ and SO₂. A detailed study was conducted with 1576 lifelong non-smokers in Beijing, China, to assess the effects of both indoor and outdoor in pollution. Subjects were classified as industrial, residential or sub urban⁸. The prevalence of wheeze did not differ greatly between the three geographical areas. The epidemiological study conducted by Dr. Sivanandhan in and around Pollachi in industrial, urban and rural areas in 2009 to 2010 also showed more or less same level of (10% to 15%) prevalence rate of allergic disorders like bronchial asthma and allergic rhinitis.⁹

In our study also, we selected two industries where the workers are daily exposed to dust like coconut husks, coconut fibres and cotton dusts. In Suriya Spinning Mill, the heads of the workers are covered with a white layer of cotton dusts. Few of the workers are covering their nose and mouth with some cloths; but most of the workers are not wearing faces mask. In Sri Dharma Sastha Coir Industry also, the workers are not wearing face masks. Actually, we are able to remove a thick layer of brown-coloured coconut husks from their nostrils. In Suriya Spinning Mill out of 94 workers, only 9 (9.6%) persons started having either bronchial asthma and allergic rhinitis or both after joining the mill. Hence the prevalence rate of bronchial asthma / allergic rhinitis is 9.57% only. If we include the worker who are having bronchial asthma before joining the mill, then total number of workers affected is 12 and the prevalence rate is 12.7%.

In case of Sri Dharma Sastha Coir Industry, out of 19 workers only 3 persons are showing allergic manifestations and the prevalence rate is 15.8% which is as in the case of other rural and urban areas.

Although most of the workers are working for more than 20 years, they are free from allergic disorders. Hence it is evident from our study that exposure to allergens such as cotton dust in Spinning Mill and Coconut husk and fiber in Coir Industry are not the causative factor for Bronchial asthma and allergic rhinitis; perhaps these allergens may act as triggering factors in precipitating the asthmatic attacks.

CONCLUSION

The above epidemiological study of asthma among occupational hazards workers in and around Pollachi clearly showed that just exposure to dust and other pollutants in the atmosphere along will not be cause for developing allergic disorders, like bronchial asthma, allergic rhinitis, etc. but also there must be associated other factors such as genetic susceptibility life style, diet, antenatal infection, early childhood infection etc.

Hence further epidemiological study is required to find out the cause for epidemics of allergic disorders like asthma.

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