BIOALLERGENS IN THE AIR OF SELECTED AREAS IN VIJAYAWADA

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ABSTRACT

People routinely exposed to the heavy traffic suffer from respiratory diseases like asthma, acute bronchitis due to the presence of bacteria, fungi and organic dusts in the air. Life at these areas studied became a health hazard. A survey of aerospora conducted in five selected areas of Vijayawada showed that bacteria and fungi were present in the order of $3x10^3$ and $2x10^3$ respectively. Twenty one fungal species and seven bacterial species were present in the present study. Many filamentous fungi known to be aeroallergens were present, Aspergillus being the predominant species. Pathogenic bacteria like Pseudomonas, Staphylococcus, were present in many areas of study. The threshold limit value (TLV) and Biological exposure indices values should be liaised for every area in the city which will serve as guide to control health hazards.

Keywords: *Microflora, Vijayawada, Fusarium and Helminthosporium.*

INTRODUCTION

Increase of population and developmental programs in the world have resulted in extensive urbanization regardless of environment considerations, leading to air pollution and climate changes. These consequences are purely anthropogenic causing unpleasant effects on biotic communities, the effects often extending to large air pockets even at a distance.

Pollutants include particulate and gaseous matter. Particulate matter of biological origin can be a major cause of respiratory ailments to humans, causing allergies and pathogenic infections of the respiratory tract. In this investigation we term these pollutants as bioallergens. Allergic sensitization of the intrathorasic airways (asthma) or lung parenchyma (hypersensitive pneumonitic) may be a major health problem and this is of concern in the long term for exposure to inhaled bioallergens[1].

Extrinsic allergic alveolitis is a serious hypersensitive response usually associated with repeated exposure to spores of thermophillic actinomycetes. Aspergillosis and Histoplasmosis are serious fungal infections of humans, initiated by spores deposited in the alveoli, they can be life-threatening diseases in immunocompromised people, when the fungi disseminate from the lungs to major organs of the body.[2]

Air sampling is used routinely in developed countries to monitor the population of air particulates, and to inform the public through broadcasting. It is used by the major hospitals to monitor the population of specific allergenic particles like fungal spores so that the causes of patient's allergies can be determined.

The recognition of existing and potential dust or allergen hazard is the first step towards improving health and safety of people exposed. Health hazard evaluation requires the collection of quantitative and qualitative data on the bioallergens present in the environment. Vijayawada is a fast developing urban area which has seen steady growth of industries resulting in pollutants of all kinds. Heavy traffic and air pollution has increased several fold adversely affecting the health

of people living in and around Vijayawada. A study has therefore been undertaken to 1) Quantify the microbial population in the air in some selected areas of the city and 2) identify the potent bioallergens which cause various types of allergies .

EXPERIMENTAL

Sample sites

Five randomly selected areas in Vijayawada representing different environmental conditions were chosen in the present study.

(1).Pandit Nehru bus station (RTC Complex), (2) Ramavarpadu Ring Road, and (3). Benz centre representing areas with heavy traffic(4). Kaleswara Rao Market consisting of vegetable market and cereals market and (5). Auto Nagar representing industrial and slum area with lot of mechanical garages.

Isolation and Identification of Microflora

For isolating fungi present in the air, Petridishes containing Rose Bengal Agar with chloramphenicol were exposed for a period of 30 minutes. The exposed plates were incubated for five days in an incubator at 26°C. The fungi developed after seven days were observed under a compound microscope after staining with cotton blue. The cultural and morphological characteristic of fungi were identified by the use of pictorial atlas of soil and seed fungi [3].

For isolating bacteria nutrient agar plates were exposed to air for 30 minutes and incubated at 37°C. Bacterial isolates were identified based on the morphological characters like colony color, texture, followed by biochemical tests performed according to standard protocols.[4] (Table1)

RESULTS AND DISCUSSION

Occurrence of Microflora

Various test sites showed the presence of bacterial and fungal contaminants as given in Table 2 and 3. A total of 21 fungal and 7 bacterial species were isolated from the sampling stations.

The air borne particulate matter collected from all the 5 areas in the present study viz… Pandit Nehru bus station (RTC Complex), Ramavarpadu Ring Road, Benz centre, Kaleswara Rao Market, Auto nagar showed abundant bacterial and fungal propagules. Bacterial population was more in the air in all the samples compared to the fungal population. While the bacterial population ranged from 2×10^3 to 3×10^3 cfu, fungal population ranged from 3×10^2 to 1×10^3 cfu. (Table 4).

Respiratory diseases were noticed in the workers of factories exposed to *Pseudomonas and Bacillus subtilis.*[2]. In the present study these two genera are present in all the sampling sites posing a potential risk of respiratory allergies (Table 3). Filamentous fungi represent a major hazard for people exposed to organic dusts. The ß-D glucans, the basic polyglucose constituents of fungal cell wall occurring in the air in the concentration of 10^{-2} - 10^2 ng/m^3 can cause chronic lung inflammation and evoke disease.[5,6,7] In the present study many fungal species were observed in the air which exert adverse effects on the respiratory tract of exposed people. Among them the most important are *Aspergillus flavus, Mucor recemosus* dominant in RTC complex area, As this species is known to be potential aeroallergen it could well be a health hazard to all people traveling regularly from this bus station. (table 2), Bacillus subtilis, in the kaleswara Rao market and Escherichia coli in the auto nagar area.(Table 3) also causes severe health hazard to the people residing around..

According to Lacey and Dutkiewiez[2] *Rhizopus* is known to cause organic dust toxic syndrome (ODTS). In the present study spores of *Rhizopus* are abundantly found market and autonagar areas(Table 3) .

Bacillus subtilis and *Proteus* were predominant microflora in the kaleswara rao market. The presence of pathogenic bacteria like *Staphylococcus, Streptococcus and Pseudomonas* is dangerous and preventive hygiene and safety measures for eradication of these bacterial strains should be the first priority.

The bacterial population was highest in the air samples collected from AutoNagar. This can be explained by the presence in the vicinity of sampling area a slum improper sanitary conditions and garages for the mechanical workshops. Further the presence of waste oil and dusty roads are conducive for bacterial growth. *E.coli* was predominant in this slum area.(table 3) The presence of *E.coli* warrants the need to take safety measures. In this context hygiene living conditions like cleaning of drains and spraying of antibacterial chemicals have to be implemented.

The fungal population in this auto nagar area comprises plant pathogens like *Fusarium* and *Helminthosporium*.

Ramavarapadu ring raod and benz centre are the two important areas of Vijayawada with a dense vehicular traffic releasing noxious gases like CO, CO_2, SO_2 and NO_2 into the air. Such vehicular traffic conditions, the bacterial and fungal spores seem to range around 10^2 to 10^3 cpu/m^3 as compared to 10^6 - 10^9 cpu/m^3 in the farming atmosphere.[8] This range is not an alarming figure and hence not a serious health hazard. However, the present project covered only a duration of 3 months (December to March).. Studies throughout the year covering different seasons may indicate significant differences in the levels of aerospora in different areas of Vijayawada. . Results of this investigation was compared with the allowed standards of developed countries.

Establishing of occupational exposure limit:

The American conference of government industrial hygienists (ACGIH) publishes a book containing TLV (Threshold limit value) and BEI (Biological exposure indices)[9]. These values listed are used by hygienists as guidelines to assists in the control of work place hazards.

The knowledge about health risks due to mold exposure is not widespread and health authorities in developing countries may not be aware of the potentially serious reactions that the exposure can evoke.

To the best of our knowledge so far the occupational exposure limit (OEL) or threshold limit values (TLV) for aerospora have not been elaborated and introduced as legislations any where in our country. The necessity of such values is unquestionable.

CONCLUSIONS

1. The recognition of potential bioallergen hazard is the first step towards protecting against dust exposure
2. Health hazard evaluation requires the collection of qualitative and quantitative data.
3. Time studies across different seasons of the year would indicate the levels of dust people are being exposed to in different parts of the city.
4. The threshold limit value (TLV) and Biological exposure indices (BEI) values should be liaised for every area in Vijayawada which could be used as guide line to control health hazards.

5. Occupational exposure limit (OEL), levels of particulate matter should be determined and proper legislation made to ameliorate the hazards of dust pollution.

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Table-1 : Identification of bacteria

S. No	Test	Bacillus sp.	Staphylococcus aureus	Escherichia coli	Enterobacter aerogenas	Proteus vulgaris	Pseudomonas aeruginosa
1.	Gram staining	Rod, G +	Coccus , G +	Rod, G -	Rod, G -	Rod, G -	Rod, G -
2.	Cultural characteristics	Abundant, opaque white waxy growth	Abundant, opaque golden growth	White moist glistening	Abundant thick white glistening	Abundant thin blue grey swarming growth	Abundant thin white, medium turns green
3.	Gelatin liquification	+	+	-	-	+	+
4	Starch hydrolysis	+	-	-	-	-	-
5.	Lactose fermentation	-	A	AG	AG	-	-
6.	Dextrose fermentation	A	A	AG	AG	AG	-
7.	Sucrose fermentation	A	A	A	AG	AG	-
8.	H_2S production	-	-	-	-	+	-
9.	Indole Production	-	-	+	-	+	-
10.	MR reaction	-	+	+	-	+	-
11.	VP reaction	$\pm$	$\pm$	-	+	-	-
12	Citrate utilization	-	-	-	+	-	+
13	Urease	-	-	-	-	+	-
14	Catalase	+	+	+	+	+	+
15	Oxidase	+	-	-	-	-	+
16	Specific medium / character	Spore formation	Growth on mannitol salt agar medium	Metallic sheen on EMB agar medium			Growth on cetrimide agar, production of green colour

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Table-2 : Percentage of different fungal species at sampling stations

S. No	Fungal species	RTC complex	Ring Road	Benz Centre	Kaleswara Rao Market	Auto Nagar
1	*Alternaria alternata*	1	-	2	13	6
2	*Aspergillus flavus*	12	8	7	14	11
3	*Aspergillus fumigatus*	3	12	6	-	14
4	*Aspergillus niger*	2	11	4	8	3
5	*Botrytis sp.*	-	-	-	6	11
6	*Cercospora sp.*	-	-	11	-	16
7	*Chaetomium sp.*	-	-	-	3	-
8	*Cladosporium*	-	12	9	-	
9	*Curvularia sp.*	6	-	-	-	10
10	*Fusarium solani*	13	6	11	19	15
11	*Gonatobotrys sp.*	-	-	-	-	-
12	*Helminthosporium sp.*	7	11	-	8	16
13	*Mortierella hyalina*	2	-	-	-	-
14	*Mortierella zonata*	-	-	-	7	11
15	*Mucor microsporus*	-	-	23	4	-
16	*Mucor racemosus*	20	-	4	3	1
17	*Penicillium sp.*	1	13	13	21	-
18	*Rhizopus oryzae*	-	-	9	12	13
19	*Rhizopus stolonifera*	-	-	2	6	-
20	*Verticillium sp.*	-	-	-	5	-
21	*Yeast cells*	14	18	-	23	-

Table-3 : Percentage of different bacterial species at sampling stations

S.No	Bacterial species	RTC complex	Ring Road	Benz Center	Kaleswara Rao Market	Auto Nagar
1.	*Bacillus subtilis*	18	16	21	46	22
2.	*Escherichia coli*	13	11	09	11	40
3.	*Proteus vulgaris*	-	16	14	19	10
4.	*Pseudomonas sp.*	29	21	13	13	10
5.	*Staphylococcus aureus*	5	12	10	15	11
6.	*Enterobacter aerogenes*	-	16	11	18	7
7	*Streptococcus sp.*	2	-	-	2	-

Table-4:Bacterial and Fungal Colony Forming Units (CFU) in the Air of Vijayawada

S.No	Sampling area	Bacterial	Fungi
1	Pandit Nehru (RTC Complex)	$2.1x10^3$	$1.1x10^3$
2	Benz centre	$2.4x10^3$	$1.2x10^3$
3	Ring Road	$2x10^3$	$1.4x10^3$
4	Kaleswara Rao Market	$2x10^3$	$2.5x10^2$
5	Auto Nagar	$3x10^3$	$3.4x10^2$

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Any fool can make things bigger, more complex, and more violent. It takes a touch of genius - and a lot of courage - to move in the opposite direction.
-Albert Einstein