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Assessment of Biological Allergens in Air & Dust in Shendi Town

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Abstract: **People are exposed to a variety of potentially harmful agents in the air they breathe, the liquid they drink, the food they eat, the surface they touch and the products they use. An important aspect of public health is the prevention or reduction of exposures to environmental agents that contribute, either directly or indirectly, to increased rate of death, disease, discomfort or disability.**

The objectives of this study are to measure the quality of biological agents i.e. bacteria and fungi in air and dust at Shendi town and to show the types and the presence of the allergens in the area.

The study was conducted by environmental monitoring, questionnaire and time - activity surveys. The town has been divided into five sectors, from each sector 24 air samples were collected randomly by multistage sampling technique; the total is 180 samples.

All project's data are stored in Microsoft Excel spreadsheets. The preliminary characteristic and indoor pollutant exposure range also were calculated using Excel. Data were also exported to SPSS for additional statistical analyses. Descriptive analyses included frequencies, means and standard deviations as well as analysis of variance for mean comparisons and analyses for categorical variables.

The total exposed Petri dishes for bacteria growth were 120. Most of them were Gram –ve baclli 13 species. The most abundant frequent species were *Pseudomonos aeraginosa, Hafnia alvei, E.coli, Cedecea davicae, Providincia rettgeri and Klebsiella pneumoniae*. Of the total 120 exposed Petri dishes fungal spores were collected on only 105. The colonies were identified up to the specific level into 17 species. The most abundant frequent species were *Aspergiluis, Penecillium, Alternaria; Cladospormm; Curvularia; Fusarium*. Thus a comprehensive study, of indoor air biological species, should be done by the Sudanese Standards &Metrology Organization (SSMO) in order to establish Standards for biological allergens.

Keywords: **Air, Dust, Allegens, Shendi.**

1. INTRODUCTION

All of us are exposed to biological pollutants. However, the effects on our health depend upon the type and amount of biological pollution and the individual person. Some people do not experience health reactions from certain biological pollutants, while others may experience one or more of the following reactions:

-Allergic
-Infectious
-Toxic

Except for the spread of infections indoors, allergic reaction may be the most common health problem with indoor air quality in homes. They are often connected with animal dander (mostly from cats and dogs), with house dust mites (microscopic animals living in household dust), and with pollen. Allergic reactions can range from mildly uncomfortable to life-threatening, as in a severe asthma attack.

Health experts are especially concerned about people with asthma. These people have very sensitive airways that can react to various irritants, making breathing difficult. The number of people who have asthma has greatly increased in recent years. The number of people with asthma has gone up by 59 percent since 1970, to a total of 9.6 million people. Asthma in children under 15 years of age has increased 41 percent in the same period, to a total of 2.6 million children. The number of deaths from asthma is up by 68 percent since 1979, to a total of almost 4,400 deaths per year.

2. MATERIALS AND METHODS

The study was conducted by:

2.1-Environmental monitoring:

Outdoor and indoor air samples, for identification of the biological agents, were collected. The air samples were collected from residential areas, using air- Sampling pump, at a flow rate of 15 L / min. for 1 hour. Bacteria and Fungal spores in the indoor and outdoor air were collected and studied by a combination of two methods-visual counts on filter and culture. In the former method the filters were exposed horizontally for 1 hour in an air- sampling pump, placed at a height of 1m. In the culture method 8 cm petri dishes containing corn meal agar (for fungal spores) and nutrient agar (for Bacteria) were exposed for a period of 3 min monthly at 10 a.m. This particular period was found to be most suitable for representing average weather conditions (temperature and humidity) of the days around the year with only slight variations. The petri dishes were placed on a stand and exposed horizontally at a height of 1 m above and parallel to the ground, adjacent to the gravity spore catching. The exposed Petri dishes were then incubated at 37°C for 5 to 10 days. Depending on the growth, some of the fast growing colonies were isolated for subculture on nutrient media to avoid masking of small colonies. After suitable growth of the colonies examination and identification were done. The individual types were isolated by sub-culturing them on tube containing nutrient media. These sub-cultures were maintained for confirmed identification. The isolated Bacteria were identified be using Gram stain whereas the isolated fungi were identified microscopically. Dust samples, for seasonal and between-home variation, were also collected from bed rooms and living rooms.

2.2-Questionnaire:

Questionnaires typically provide qualitative, often retrospective, information. So the questionnaire is used to categorize respondents, and is commonly used to aid in interpretation of personal and environmental results. Thus, 60 questionnaires from the five sectors provide basic socio-demographic data, physical characteristics of the residential environment linked to health status.

2.3-Time - activity surveys:

To have information about rates of contact between persons and pollutants in different microenvironments the following factors were studied:

a. The amount of time spent in a given activity.
b. The time of day, week and year of contact.
c. The expected frequency with which the person or population engaged in the activity.

2.4-Sampling frame:

The town was been divided into five sectors, from each sector 24 air samples (12 indoor and 12 outdoor) (for bacteria) plus 24 samples (12 indoor and 12 outdoor) (for fungi), were collected. The samples were collected randomly by multistage sampling technique; the total is 180 samples (outdoor, indoor air and dust samples see *table (2.1*).

Table (2.1) the sampling time frame

sectors / Weeks	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
1	5 Samples	5 Samples	5 Samples	5 Samples	5 Sample
2	5 Results	5 Results	5 Results	5 Results	5 Results

The above time frame activity table has been repeated monthly at each sector for 12 months.

2.5-Readiness:

Prior commencement of the activities in the project's homes, readiness was assessed by field trial of equipment and procedures at non-project test homes. Instrument performance, samples collection, field team performance and data handling were monitored and judged and they are acceptable. Five homes were tested as field trial. Data collected during these trials established the need for lower laboratory based quantization limits and particulate matter. Different laboratories were identified and used subsequently i.e. the faculty of medicine and health sciences' laboratory, Khartoum state ministry of health laboratory and the national health laboratory departments of occupational health and departments of mycology.

2.6-Data Analysis:

All project data are stored in Microsoft Excel spreadsheets. The preliminary characteristic and indoor pollutant exposure range also were calculated using Excel. Data were also exported to SPSS for additional statistical analyses. Descriptive analyses included frequencies, means and standard deviations as well as analysis of variance for mean comparisons and analyses for categorical variables. Environmental and biological measures were categorized for some analyses; cutoff values were selected based on a combination of literature values, significance, experience of project staff, and the distributions observed in the study data. The tables, figures and pictures present the results of the analyses of several demographic characteristics of the study population and the outcome of the different laboratories. A walk-through inspection was performed to record home and occupant characteristics. Homes were evaluated for dampness, cleanliness, pets, pests, and potential indoor pollutant sources.

3. RESULTS

The study enabled the following results to be drawn:

The study shows that (81.6 %) of the families have 3 – 5 rooms in their houses with both types of ventilation (80%) supported with windows, three in each room.

The study shows the existence of different types of animals in the homes 55%, plants 81.7% and insects 70%. 60% of the families complain from respiratory tract infection and the common signs and symptoms are watery eyes, running nose, sneezing, coughing, wheezing, difficult breathing, headache and fatigue. The study shows that 75% do activities such as cleaning 63% and cooking 6.7%). Also 1 to 4 persons are suffering from asthma (29.3%), most of them are young children and elderly people.

In this study ,for indoor environment, relative humidity is ranked as highly significant followed by air velocity, then the average cooling time, the site and the sampling time, compared with relative humidity followed by the average cooling time, then the sampling time, the site and the air velocity in outdoor environment .

In this study *Pseudomonos aeraginosa, Hafnia alvei, E.coli, Cedecea davicae, Providincia rettgeri* and *Klebsiella pneumoniae* are the most found bacteria .The fungal Species of *Aspergillus, Alternaria, Curvularia, Fusarium, Penecillium, Bipolaris* showed excellent growth on exposed culture media. Several other types of spores were also found in comparatively low numbers. The most abundant frequent types were *Aspergillus* sp, *Alternaria* sp, *Curvularia* sp , *Bipolaris* sp, *Aureobasidium* sp, *Fusarium* sp, *Zygomycotes* sp and *Penecillium* sp.The maximum frequency of fungal Species was found during December February , March, April and May . The lowest numbers of fungal spores was found in the rainy months, i.e. June, July, August and September. However, individual types of fungal spores exhibited their own maximum and minimum frequency distribution during different months and seasons.

The study demonstrates the following categories of the fungal spores in the air:

(i) Occurring almost throughout the year: *Altemaria and Aspergillus* spp.

(ii) Those common during February to May: *Altemaria tenuis, Aspergillus niger, Curvularia clavata, Bipolaris* sp, *Fusarium* sp and *Penecillium* spp.

(iii) Those having high concentration during December to April: *Aspergillus niger, Altemaria tenuis, Fusarium spp.*

(iv) Those having their peak abundance during May to August: *Aspergillus spp* .

Table (3.1) shows ranking of the variables indoor ANOVA

Tests	Source	Mean Square	F	Sig.
Between Groups	**relative humidity**	305.997	6.069	.000
	air velocity	119.022	3.452	.000
	average cooling time	792.839	2.495	.001
	Site location	.371	1.686	.038
	sampling time	12.044	1.093	.366

Table (3.2) shows ranking of the variables outdoor ANOVA

Tests	Source	Mean Square	F	Sig.
Between Groups	**relative humidity**	406.491	7.567	.000
	average cooling time	910.567	2.715	.001
	sampling time	18.521	1.849	.031
	Site location	.273	1.097	.367
	air velocity	30.544	.547	.922

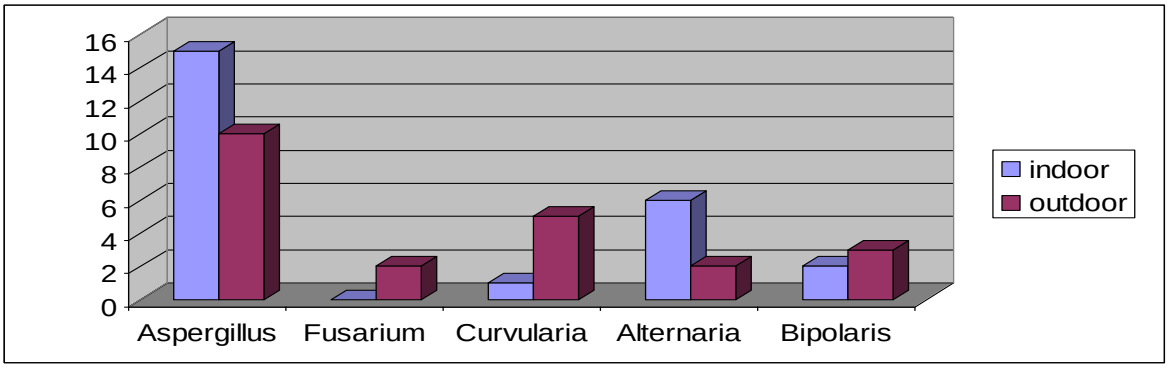

Figure (3.1) shows Comparison between the frequencies of the main found molds in air in Shendi

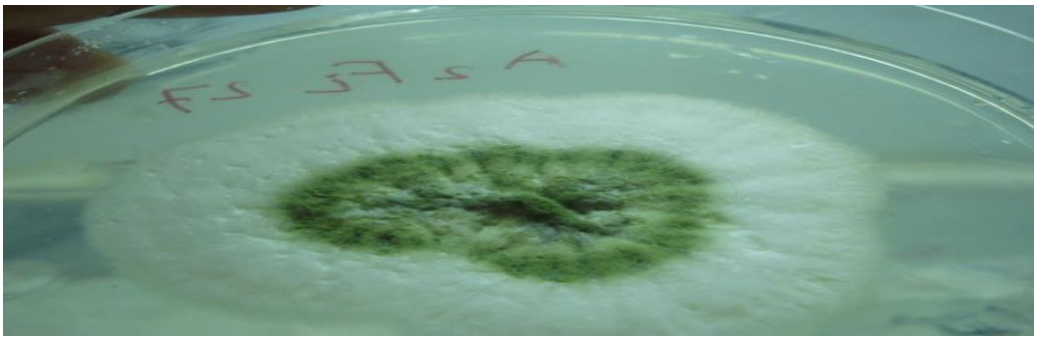

Figure (3.2) shows colony of Aspergillus *spp 2* on corn meal agar from indoor air of sector 2 taken at January (sample A2fi)

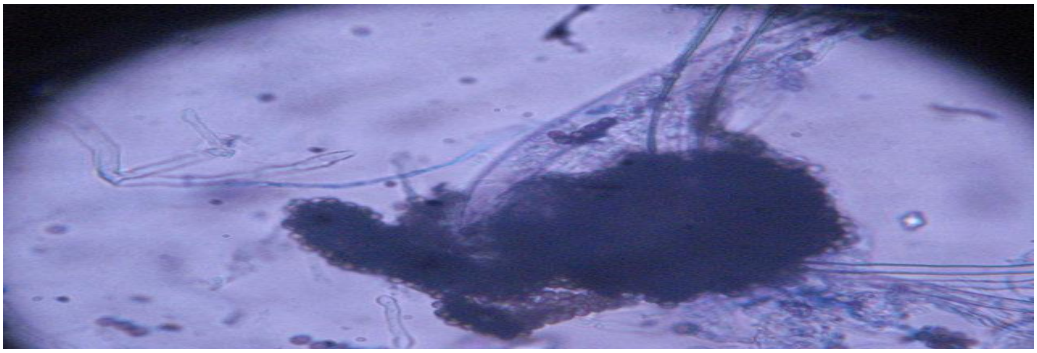

Figure (3.3) shows microscopic view of Aspergillus ***spp*** **stained by lactophenol coton blue (sample A2fi)**

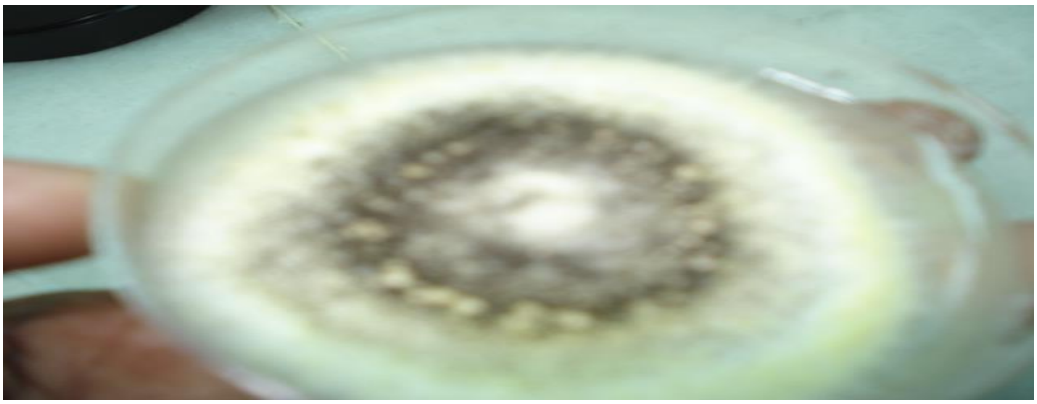

Figure (3.6) shows colony of *Alternaria spp* on corn agar from indoor air of sector 2 taken at February (sample B2Fi)

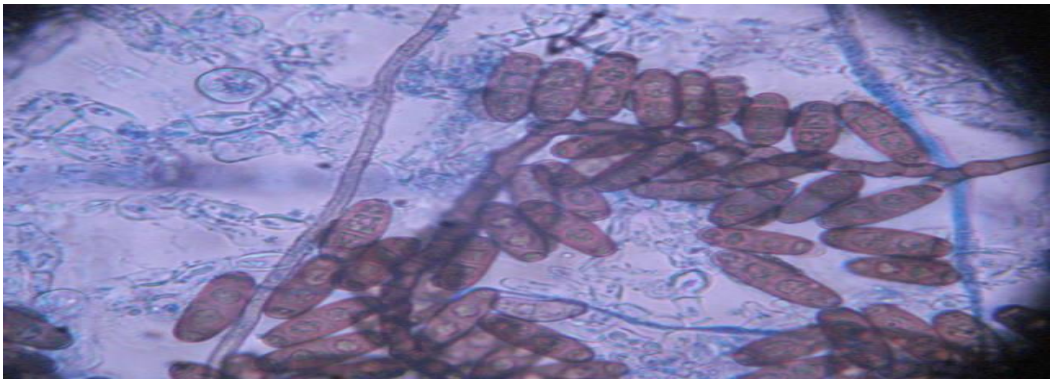

Figure (3.7) shows microscopic view of Alternaria *spp* stained by lactophenol coton blue (sample B2Fi)

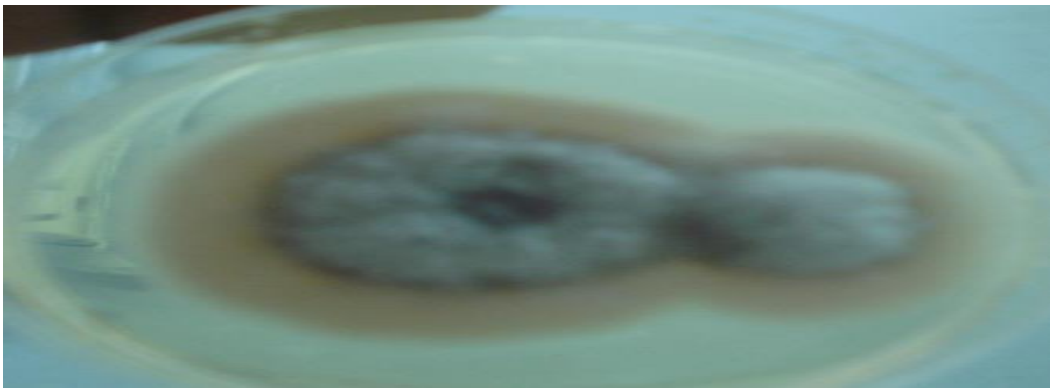

Figure (3.5) shows colony of *Bipolaris spp* on corn meal agar from indoor air of sector 1taken at February (sample B1Fi)

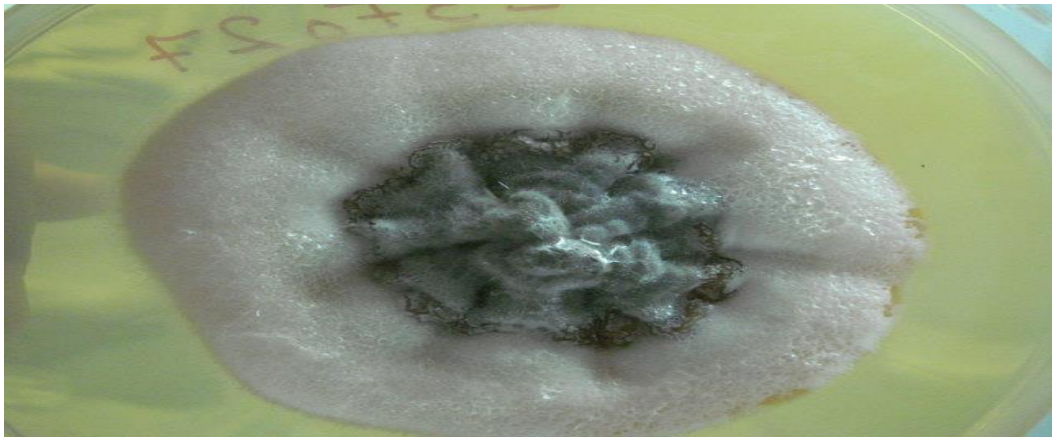

Figure (3.9) shows colony of Curvularia spp on corn meal agar from outdoor air of sector 3 taken at May (sample E3Fo)

4. DISCUSSION

While exposure assessment can be used to estimate exposures experienced by the "average" individual, it is often used to address populations most likely to be at risk. This includes populations likely to experience the highest exposures, as well as those most susceptible to these exposures. Host factors, such as activity, lifestyle, behavior and susceptibility, must be taken into consideration.

In this study the number of children under 15 years in a family ranged between 1to 12 (75%), 60% of the families complain from respiratory tract infections and the common signs and symptoms are watery eyes, running nose, sneezing, coughing, wheezing, difficult breathing, headache and fatigue 80% , air pollution can affect our health in many ways with both short-term and long-term effects. Different groups of individuals are affected by air pollution in different ways. Some individuals are much more sensitive to pollutants than are others. Young children and elderly people often suffer more from the effects of air pollution (1)

Many ordinary activities such as cooking, heating, cooling, cleaning, and redecorating can cause the release and spread of indoor pollutants at home (1).The study shows that 75% do such activities, cleaning 63% and cooking 6.7% . Also 1 to 4 persons are suffering from asthma (29.3%) most of them are young children and elderly people.

Many people spend large portion of time indoor - as much as 80-90% of their lives. We work, study, eat, drink and sleep in enclosed environments where air circulation may be restricted. For these reasons, some experts feel that more people suffer from the effects of indoor air pollution than outdoor pollution. (1)

In this study different species of molds was found and 80% of the occupants complain from respiratory tract infection and the common signs and symptoms are watery eyes, running nose, sneezing, coughing, wheezing, difficult breathing, and headache and fatigue which typical to molds disorders signs and symptoms.

In this study ,for indoor environment, relative humidity is ranked as highly significant followed by air velocity, then the average cooling time, the site and the sampling time (table3.1), compared with relative humidity followed by the average cooling time, then the sampling time, the site and the air velocity outdoor(table3.2). Moisture is the principal determinant of mold growth indoor. In this study molds are detected both indoor and outdoor, (Figure 3.1).

In the present study large numbers of fungal propagates, small round spores and smut spores are of common occurrence. However, many of the spores types, are specific to the atmosphere of this locality such as *Aspergillus* sp, *Alternaria* sp,*Curvularia* sp, *Bipolaris* sp, *Aureobasidium* sp, *Fusarium* sp, *Zygomycotes* sp and *Penecillium* sp. The concentration of these fungal spores varies from month to month, and season to season. The maximum number of spp was found during December, February, March, April and May. The lowest numbers of fungal spores was found in the rainy months, i.e. June, July, August and September. However, individual types of fungal spores exhibited their own maximum and minimum concentration during different months and seasons e.g. *Aspergillus*, *Altemaria*, *Curvularia and Bipolaris,*were found , more or less , in many months of the year; other types showed a more or less seasonal pattern. The occurrence of many of these spores is related to their production, and to rain, temperature and wind velocity in the locality.

Some of the found fungal spores are similar in appearance (small round spores) did not identified up to the generic level from the slides. Many of these were, however, identifiable to the specific level in the culture media (the pictures). Similarly, many of the spores found on the slides did not grow well in the culture media, e.g. *Exserohilium* sp., *Bactrodesium* sp., *Phaeosclera* sp., *Pseudoallscheria* sp, *Cladosporium* sp, *Absidia* sp, *Chactomium* sp and Ascotrchia sp. Thus, the present results support the necessity of combing the methods.

The air borne fungal spores at corn meal agar show great richness qualitatively as well as quantitatively as compared to the studies conducted at Kanpur (Rajan *et al.*, 1952), Saugar (Mehrotra and Claudius, 1968) and Delhi (Agarwal *et al.* 1969). Though every locality represents its own aerobiota, as commented by Hamilton (1959), Lacey (1962), Sreeramulu and Ramalingam (1966) and Gregory (1967).

Though many of the spores in the air showed variations with respect to weather conditions, however smut spores did not exhibit marked seasonal variations and occurred in the air in many months of the year, probably due to their wide range of availability in the locality. Thus, the seasonal periodicity of fungal spores with respect to variation in weather resembles the general principles.

5. CONCLUSION

Qualitative analysis of the viable bacteria and fungi was done using well established methods. The accuracy of the project has completed by the survey of 60 homes includes sample collection, culturing and identification and classification of bacteria and fungi. Analysis of the data is in various stages of progress. Viable microorganisms and Samples were collected during the visits to the 60 homes.

The study demonstrates the following categories of the fungal spores in the air:

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(iv) Those having peak abundance during May to August: *Aspergillus spp*

Thus a comprehensive study, of indoor air biological species, should be done by the Sudanese Standards &Metrology Organization (SSMO) in order to establish Standards for biological allergens.

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