Microbial Indoor Air Contaminants and it's Health Risk Assessment in Different Microenvironments of Lucknow : Capital of most Polluted State of India

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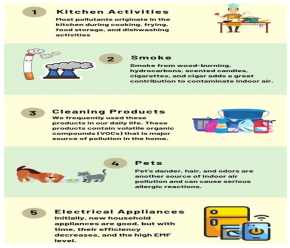
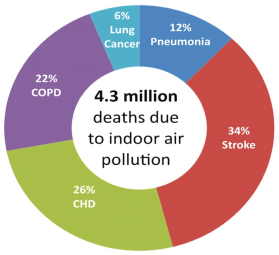
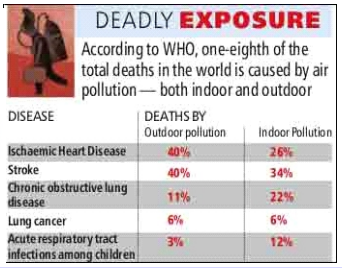
INTRODUCTION

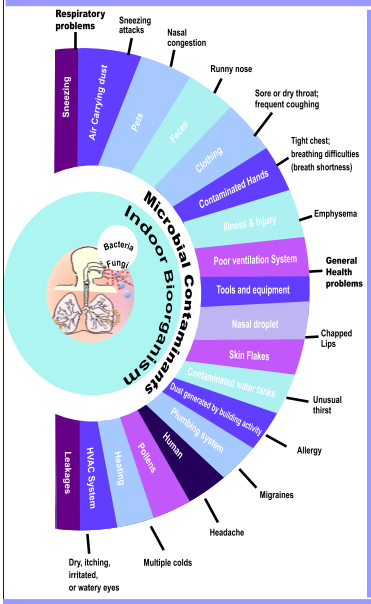
- World Health Organization (WHO) has released Air Quality Database 2022, which shows that Almost the entire global population (99 %) breathes air that exceeds WHO's air quality limits.
- The combined effects of ambient air pollution and household air pollution are associated with 6.7 million premature deaths annually.
- More than 2.6 crore cases of acute respiratory infections reported every year in the country- Health and Family Welfare Ministry
- Each year, 3.2 million people die prematurely from illnesses attributable to the household air pollution.
- A record number of over 6000 cities in 117 countries are now monitoring air quality, but the people living in them are still breathing unhealthy levels of pollutants.
- 94% people live in areas where it exceeds India's own air quality standard.
- Biological pollutants promote poor indoor air quality and may be a major cause of days lost from work or school, and of doctor and hospital visits, and can travel through the air and are often invisible.
- Two surveys of homes in northern U.S and Canada shows that 30% to 50% of all structures have damp conditions which may encourage the growth and buildup of biological pollutants.







DISEASE	DEATHS BY Outdoor pollution	Indoor Pollution
Ischaemic Heart Disease	40%	26%
Stroke	40%	34%
Chronic obstructive lung disease	11%	22%
Lung cancer	6%	6%
Acute respiratory tract infections among children	3%	12%



METHODOLOGY

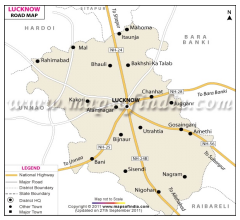
Study Location

Microenvironment-Households

Study was conducted in Lucknow City between two Seasons i,e., Spring Season 2022 and Winter 2022-23

Two Households were selected from each locality

- Residential Belt
- Commercial Belt
- Industrial Belt



Objectives

To quantify the Concentrations of Bacteria and fungi in the different microenvironments

To know about the seasonal variation of microbial contaminants (bacteria and fungi) within the households

Health Risk assessment was done on obtained research

Step1: Monitoring
The passive method (gravitational settling method) was used to collect air samples from the inside of homes in three distinct microenvironments (residential, commercial, and industrial).

Step 2: Sample Collection
The Petri dishes (9 cm in diameter) were exposed for 60 minutes at a breathing height of around 70 cm in the kitchen, bedroom and washroom of houses with media of nutritional agar (NA), for bacteria, and potato dextrose agar (PDA) and RBA (rose Bengal agar), for fungal sample.

Step 3: Procedure and analysis
All of the agar plates were sealed after exposure and brought to the lab for incubation; the bacterial plates were kept there for 24-48 hours at 37 °C, and the fungus plates for five to six days at room temperature (25-27 °C).

Step 4: Quantification
The number of bacteria and fungi was counted as colony-forming units (CFU), and the formula for CFU/m3 was used to calculate it:

$N = 5a * 10^{2} (bt)^{-1}$

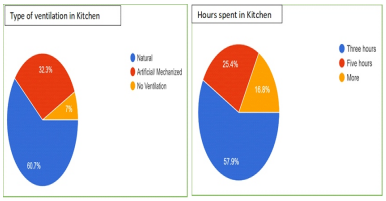
RESULTS





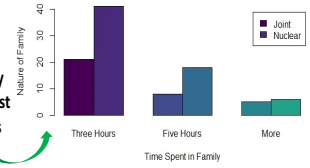

57.9% of the women were said to spend more than three hours a day in the kitchen.

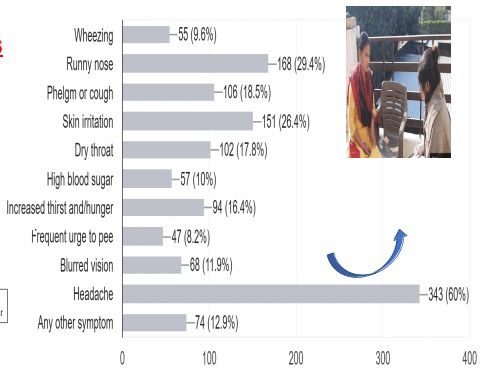
Survey Outcomes



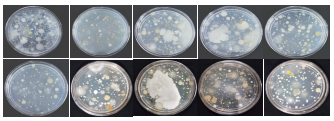
An interconnection between the average time spent in a day by women and the nature of family through a chi-square test performed in R-studio revealed that women in joint families spent more time.

Furthermore, it was shown that 57.9% of the women worked in the kitchen for longer than three hours per day. The interior air quality in kitchens is allegedly significantly worse than outdoor air, according to another research

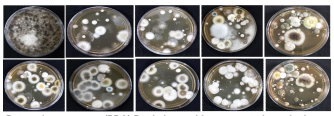




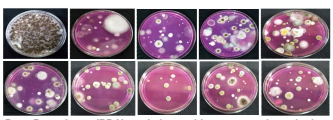
Further, it was also reported that 29.4%, of women, faced runny noses, and 26.4% from skin irritation.



Nutrient agar (NA) Petri plates with representative colonies of bacteria (highly polluted)



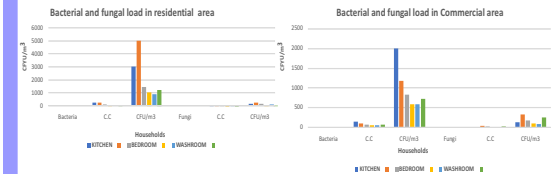
Potato dextrose agar (PDA) Petri plates with representative colonies of Fungi (heavily polluted)

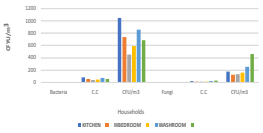


Rose Bengal agar (RBA) petri plates with representative colonies of fungi (highly polluted)

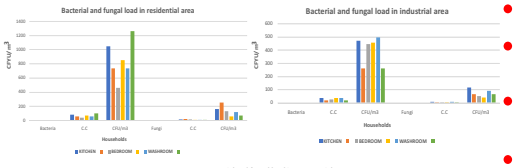
SEASONAL VARIATION IN BACTERIAL AND FUNGAL LOAD

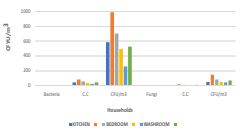
Spring Season





Winter Season





CONCLUSION

- The study's findings indicate that seasonal change has an impact on microbial concentration.
- The load of bacteria and fungi in indoor air was much greater in the spring than in the winter season.
- Bacterial (4980.21 CFU/m3) at H3 and Fungal (524.23 CFU/m^{3}) at H5 loads during Summer season was found to be higher than the WHO limits.
- Dose rates for both bacteria and fungi were maximum in the kitchen showing that women may be prone to infectious diseases.
- This research will generally help us understand the diversity of microbial communities in indoor air.
- Other factors like ventilation and human activity also have an impact on the number, and diversity of bioaerosols.
- Overall, this research will contribute to our knowledge of the microbial entities variety, abundance, and community composition in indoor air and provide us with a better knowledge of the ailments and signs that indoor pollution might trigger.

In this study, Fungal genera identified from different indoor sites show that *Aspergillus spp., Penicillium, Cladosporium, and Alternaria* were present in all the sampling sites and may cause lung infections, allergic illnesses, aspergillosis, asthma, respiratory infections, and skin allergies.