Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Spl Issue [2] 2022 : 115-119

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE **OPEN ACCESS**

Impact of chronic exposure to air pollution on health of people of Delhi/NCR.

Pawan Kumar[1*], Sonisha Gupta[2], Smita Asthana,[3] Jyoti Batra[4]
[1,2] Respiratory Medicine, Santosh Deemed to be University Ghaziabad, Uttar Pradesh
[3]Scientist-E, NICPR-ICMR, Noida, Uttar Pradesh
[4] Department of Biochemistry, Santosh Deemed to be university Ghaziabad, U.P.
*Email ID: pawan.kumar@rmlh.nic.in

ABSTRACT
The air quality in Delhi, the capital territory of India is worst of any major city in the world and the national capital region is also equally affected. There is association between chronic exposure to air pollution and increasing incidence of respiratory morbidity and other systemic adverse health effects related to eye, neurological, cardiovascular, endocrine system, eye etc. To determine the respiratory and non respiratory morbidities amongst people chronically exposed to ambient air pollution. Two groups with different pattern of exposure to air pollution were chosen and comparison was done for the presence of respiratory and non respiratory morbidity amongst people. It was a cross sectional study with non probabilistic quota sampling approach. Two groups of people 245 in each group. In Group-A: road side vendors, traffic police personnel, E-Rickshaw driver and auto drivers were included. In Group-B the personnel who are working indoor inside the offices were included. Statistical analysis was done with license version of SPSS 26. Independent-T test for continuous data type for different population, Paired T-test within the group and Chi square test for categorical data were applied. The numerical data were expressed in mean ± SD while categorical data as frequency table and percentage table. In the group having chronic direct exposure to air pollution because of their nature of work there was higher reporting of respiratory symptoms such as cough, sputum and dyspnea as well as there was high reporting of non-respiratory conditions such as headache, hypertension, Diabetes Mellitus, joint pain, conjunctivitis and easy fatigability. The presence of respiratory morbidity and non respiratory morbidity was higher amongst participants having direct exposure to air pollution.
KEY WORDS: *Air pollution, Respiratory morbidity, non respiratory morbidity*

Received 21.08.2022 Revised 22.09.2022 Accepted 17.10.202

INTRODUCTION

Air pollution in India is a serious issue with the major sources being wood and biomass burning, fuel adulteration, vehicle emission and traffic congestion [1-2]. In autumn and winter months, large scale crop residue burning in agriculture fields is a major source of smoke, smog and particulate pollution [3-5]. India is the third largest per capita emissions of greenhouse gases [6]. In Delhi, between March to September, the air quality index varies from satisfactory to moderate, then October onwards it begins to deteriorate in the range of Poor (201–300), Very Poor (301–400), Severe (401–500) or Hazardous (500+) [7-9]. According to a WHO study, 13 of the 20 most-polluted cities in the world are in India [10]. As Per the survey conducted by WHO the air quality in Delhi , the capital of India, is the worst of any larger city in the world, this also affects its surrounding the national capital region [11-12]. After the beginning of Covid-19 pandemic during lock down period in Delhi there was significant improvement in air quality index [13].

Between July 2015 and February 2016, TERI University study found that 59%, 45%, 26% and 39% of the surveyed traffic police officers reported having thick sputum, pain in joints, haemoptysis and shortness of breath respectively compared to office workers [14]. The level of outdoor air pollution resulting from industrial and motor vehicle emissions has been increasing at fast rate, resulting in significant increase in the prevalence of respiratory symptoms such as coughing and wheezing [15-16]. The studies have described a positive association between ambient air pollution and higher prevalence of hypertension amongst population exposed to high ambient air pollution [17]. The meta-analysis study conducted by Bo-Yi Yang et al. showed that there was significant association of hypertension with increased exposure to air pollution [18]. The findings of studies show that long-term exposure ambient air pollution including

$PM_{2.5}$, and PM could significantly increase the incidence of T2DM [19-20]. There has been associations between air pollution exposure and epilepsy, ischemic stroke and headache [21]. The chronic exposure has been linked to increased prevalence of rheumatoid arthritis [22]. Chronic exposure to air pollution can cause cellular changes on ocular surfaces such as goblet cells hyperplasia which can lead to conjunctivitis (eye irritation) which is a significant problem [23].

Fatigue indicates a feeling of tiredness, low level of energy or muscle strength and decreased mental output. Amongst the outdoor working people, there is higher symptoms of tiredness especially in large and polluted cities an adverse impact of air pollution [24].

The studies done abroad cannot be extrapolated on Indian population due different socioeconomic, demographic and environmental factors. Very few studies in India has been done considering the difference in exposure to ambient air pollution because of the nature of their occupation. Therefore this study is aimed to address the above mentioned gap in the existing literature.

MATERIAL AND METHODS:

Two groups of 245 participants in each group with different pattern of exposure to air pollution chosen. The population of the particular area to be studied was divided into two groups i.e. Group-A and Group-B. In Group-A, the subjects included are those who are working outdoor such vendors selling eatables and other goods, traffic police personnel, E-rickshaw driver and auto drivers. In Group-B, the personnel who were working indoor i.e. inside the offices were included. This was a cross sectional study and non probabilistic quota sampling approach was used to select the participants. The participants were selected based on their features which were fulfilling the inclusion criteria. The data were entered into a predesigned and pretested questionnaire. A structured Performa which consisted of demographic profile, smoking history, co morbidities (hypertension and Diabetes Mellitus), respiratory complaints (cough, phlegm and dyspnea) and non respiratory complaints (Joint pain, eye irritation, easy fatigability and headache) was filled for each participants for both the groups. The study was conducted during December 2018 to August 2019, in Delhi/NCR.

INCLUSION CRITERIA: Personnel (working for more than two years at least 6 hours a day) of age group of 18 to 60 years, both male and female. Amongst male both smoker and non smoker included. Only non smokers female included.

EXCLUSION CRITERIA: Personnel with history of: Tuberculosis, Bronchial Asthma, Chest Trauma, CTVS surgery, Pleural effusion/empyema, ICD insertion, Cardiac ailment (CAD, Valvular Heart Diseases etc.). Personnel with the history of Neuromuscular disorders, Spinal cord deformity, any surgery of chest, abdomen, eye in the last three months, Myocardial infarction in the last three months, Use of bronchodilators in the last six hours, Interstitial Lung disease.

RESULTS AND DISCUSSION

Demographic profile of the participants are depicted in is shown in table no.-1. In Group A: - subgroup-I: non smoker male, Subgroup-II: smoker male and Subgroup III: Female. In Group B: - subgroup-IV: non smoker male, Subgroup-V: smoker male and Sub group-VI: female. 41% of participants were illiterate in group A and zero in group B. 49.80% of group B were graduate in comparison to 16.33% in group A

Table no-2 depicts the comparison of presence of symptoms and other co-morbidities of participants between sub groups.

Amongst nonsmoker male groups: There was significant (P value less than 0.05, 95% CI) higher reporting of respiratory symptoms (18.5% vs 6.3%) , dry cough (18.5% vs 9.0%), Dyspnea (7.45 vs 1.4%), non-respiratory symptoms (25.9% vs 10.5%), joint pain (56.3% vs 29.4%) , HT (29.6% vs 18.8%) , DM (26.0% vs 10.5%), Headache (56.3% vs 29.4%), Eye irritation (57% vs 21.75), easy fatigability (48.1% vs 26.6%) and overall non respiratory involvement in high exposure nonsmoker male as compared to low exposure nonsmoker male. The difference of reporting of wet cough between high exposure and low exposure group was not significant.

Amongst smoker male groups: There was no significant difference (P value>0.05) of reporting of cough, dyspnea and respiratory symptoms, non-respiratory symptoms, HT, DM, Headache, eye irritation and easy fatigability between high exposure smoker male and low exposure smoker male group which may be owing to the deleterious effects of smoking. But higher reporting of joint pain (64.3% vs 43.4%) in high exposure group which was found to be statistically significant.

Table-1: Distribution of participants according to level of Exposure to air pollution and Demographic profile of participants

Demographic Profile		Group		P-Value
		High Exposure (outdoor) (Mean ±SD)	Low Exposure (Indoor) (Mean ±SD)	
Height(cm)		163.107± 8.8563	164.397± 8.6961	0.105
Weight(Kg)		65.53± 12.564	67.13± 12.480	0.159
Age	18-30	56 (22.88%)	79 (32.25%)	0.067
	30-50	109 (44.49%)	96 (39.18%)	
	>50	80 (32.65%)	70 (28.57%)	
	Age (Mean ±SD)	43.26 ± 13.241	41.22 ± 15.186	0.114
BMI(Kg/M2)		24.434± 4.3103	24.871± 4.4184	0.269
Education Level		High Exposure (Outdoor)	Low Exposure (Indoor)	
	Illiterate	41 (16.74%)	0 (0.00%)	-
	Vth	61(24.90%)	18 (7.35%)	-
	Xth	53 (21.63%)	21 (8.57%)	-
	XIIth	50 (20.41%)	84 (34.29%)	-
	Graduation	40 (16.33%)	122 (49.80%)	-
Male	Non smoker	135 (I)	143 (IV)	-
	Smoker	57 (II)	53 (V)	-
Female	All Non Smoker	53 (III)	49 (VI)	-

*Group I (N= 135)-High exposure non smoker male. Group II (N=57)-High exposure smoker male. Group III N=53)- High exposure non smoker female. Group IV (N=143)-Low exposure non smoker male. Group V (N=53)-Low exposure smoker male. Group VI (N=49) -Low exposure non smoker female.

Table-2: Comparison of presence of symptoms and other co-morbidities of participants between sub groups:

Clinical Symptoms & Co-Morbidity	SUB GROUP*								
	I (135) No. (%)	IV (143) No. (%)	P Value	II (57) No. (%)	V (53) No. (%)	P Value	III (53) No. (%)	VI (49) No. (%)	P Value
Dry Cough	25 (18.5)	13 (9.0)	0.022	4 (7.1)	3 (5.4)	0.921	3 (5.7)	4 (8.2)	0.617
Wet Cough	5 (3.7)	3 (2.1)	0.423	10 (17.5)	5 (8.9)	0.526	7 (13.2)	3 (6.1)	0.229
Dyspnea	10 (7.4)	2 (1.4)	0.013	14 (24.6)	11 (20.7)	0.502	12 (22.6)	4 (8.2)	0.045
Respiratory System Involvement	25 (18.5)	9 (6.3)	0.003	14 (24.6)	11 (20.7)	0.502	13 (24.5)	4 (8.2)	0.027
Joint Pain	76 (56.3)	42 (29.4)	0.000	36 (63.2)	23 (43.4))	0.029	17 (32.1)	16 (32.7)	0.950
Hypertension	40 (29.6)	27 (18.8)	0.033	20 (35.1)	20 (37.7)	0.875	10 (18.9)	5 (10.2)	0.217
Diabetes Mellitus	35 (26.0)	15 (10.5)	0.000	26 (45.6)	21 (39.6)	0.348	7 (13.2)	3 (6.1)	0.385
Headache	76 (56.3)	42 (29.4)	0.000	11 (19.3)	12 (22.6)	0.989	9 (17.0)	5 (10.2)	0.302
Eye Irritation	77 (57.0)	31 (21.7)	0.000	18 (31.6)	21 (39.6)	0.451	15 (28.3)	4 (8.2)	0.009
Easy Fatigability	65 (48.1)	38 (26.6)	0.000	8 (14.0)	13 (24.5)	0.175	6 (11.3)	6 (12.2)	0.885
Non Respiratory Involvement & Co-Morbidity	35 (25.9)	15 (10.5)	0.000	8 (14.0)	13 (24.5)	0.175	7 (13.2)	6 (12.2)	0.884

*Group I-High exposure nonsmoker male. Group II-High exposure smoker male. Group III- High exposure nonsmoker female. Group IV-Low exposure nonsmoker male. Group V-Low exposure smoker male. Group VI -Low exposure nonsmoker female.

Amongst female groups: There was no significant difference of reporting of non-respiratory symptoms, joint pain, HT, DM, and Eye irritation and easy fatigability between high exposure and low exposure group. There was significant (P value less than 0.05, 95% CI) higher reporting of respiratory symptoms (24.5% vs 8.2%), dyspnea (22.6% vs 8.2%), and eye irritation (28.3% vs 8.2%).

There is association between increased prevalence of chronic cough and phlegm with PM 10 exposure amongst non smokers [25]. Similarly in the present study amongst non-smoker group, there is statistical significant higher reporting of cough amongst high exposure group than low exposure group. However in smoker group the presence of cough and dyspnea was not significantly higher amongst high exposure group than low exposure smoker group, this may be due to already deleterious effect of smoking amongst low exposure group making the difference non significant. The prevalence of cough reported in India is <5% [26]. 5.3% in industrial 7.3% non industrial town [27]. In the present study the presence of dry cough was 18.5%, 7.1% and 5.7% in high exposure non smoker male, high exposure smoker male and high exposure female group, which is significantly higher.

The symptoms of dry cough were reported more than the wet cough amongst high exposure group. The difference in presence of cough between high exposure smokers and low exposure smokers group was not significant. This reason of stronger association of cough between never smokers and ambient air pollution is unclear, the biologic effects of cigarette smoke may overwhelm the effects from long-term exposure to ambient air pollution and thus mask any association, and it is one of the explanations. A cross sectional study (BOLD) [28] conducted on 9484 participants showed female sex; increasing age; less education; both obesity and underweight; both current and past smoking history; occupational dust exposure; reported diagnoses of hypertension, heart disease, diabetes or tuberculosis; prior lung surgery and hospitalization for breathing problems as a child were all associated with increased dyspnea. Women reported more dyspnea than men (odds ratio ≈ 2.1). In the current study it was found that reporting of dyspnea was higher among high exposure non smoker male group than low exposure non smoker male group and amongst high exposure non smoker female group than low exposure non smoker female group[29-31]. However when smoker groups were compared the presence of dyspnea was not significantly different (P value >0.05) amongst high exposure than low exposure group. The factors (Independent variables) like age, sex, BMI, smoking status and Education level, which are supposed to be contributing to dyspnea were also taken under consideration and Logistic regression was applied which showed positive and significant association with smoking.

The earlier studies done have shown that chronic exposure to ambient air pollution is associated with increase prevalence of joint pain, hypertension, diabetes mellitus, headache, eye irritation and easy fatigability [32-35]. Similarly in the present study amongst high exposure group there was increased reporting of joint pain, hypertension, diabetes mellitus, headache, eye irritation and easy fatigability among high exposure group.

LIMITATIONS AND STRENGTH OF THE STUDY

Analyses were limited by the cross-sectional study design and longitudinal effects of ambient air pollution are not evaluated. Differential physical activity patterns, changes in participant residence environment and indoor housing structure having different level of indoor pollution may have contribution to the air pollution exposure level, therefore these were confounding factors. The results of the current study were based on representative populations of adults from Delhi and NCR having high level of AQI where level of pollution is in the moderate to severe category almost through the years. Whereas most previously published work has been focused on the general population not specific any particular vulnerable population but this study has taken into consideration the most vulnerable population due to nature of their occupation. Additionally, we were able to adjust for many important confounders.

CONCLUSION

There was increase prevalence of respiratory symptoms and non respiratory conditions such as headache, hypertension, Diabetes Mellitus, joint pain, conjunctivitis and easy fatigability amongst participants having direct exposure to air pollution. Spreading the awareness regarding harmful effects of air pollution and preventive measures amongst these group of population in the form of proper use of mask during their working hours. Self-reporting of any disease symptoms to nearby hospital. Early detection and treatment of comorbidity. Govt. to frame policy for their rehabilitation.

REFERENCES

1. Atkinson RW, Cohen A, Mehta S, Anderson HR. (2011). Systematic review and Meta-analysis of Epidemiological time-series. Studies on outdoor air pollution and health in Asia, air quality, atmosphere and Health.;5: 383-391.
2. Urban Air Pollution, Catching gasoline and diesel adulteration" (PDF). The World Bank. 2002.

3. Badarinath KVS, Kumar Kharol S and Rani Sharma A. (2009). Long-range transport of aerosols from agriculture crop residue burning in Indo-Gangetic Plains—a study using LIDAR, ground measurements and satellite data. Journal of Atmospheric and Solar-Terrestrial Physics. 71(1): 112–120.
4. Agricultural Fires in India NASA, United States. 2012.
5. Bob Weinhold. (2020). Fields and Forests in Flames: Vegetation Smoke and Human Health, National Institutes of Health.
6. "Co2 emissions from fuel combustion highlights, 2011 edition" (PDF). International Energy Agency, France. 2011.
7. Vishnoi, Anubhuti (2015). "IIT-Kanpur study says trucks and road dust are bigger pollutants than cars in Delhi. The Economic Times. .
8. "Delhi breathed easier (https://timesofindia.indiatimes.com/city/delhi/delhi-breathed-easier-from-january-to-april/articleshow/59011204.cms). The Times of India.
9. Air pollution: Delhi enjoys cleanest February in three years" (https://www.hindustantimes.com). 2018.
10. Burke, Jason "India's doctors blame air pollution for sharp rise in respiratory diseases". The Guardian. Retrieved 4 December 2015.
11. "Ambient (outdoor) air pollution in cities database 2014" (who.int. WHO. 2014.
12. Harris, Gardiner. "Delhi Wakes Up to an Air Pollution Problem It Cannot Ignore" The New York Times. 2015.
13. "The silver lining: air pollution dips amid the lockdown" (https://www.indiatoday.in). 2020.
14. TERI. (2015).Air Pollution and Health. Discussion paper by The Energy and Resources Institute: New Delhi.
15. Shin-ichi Sekizawa, Chao-Yin Chen, Ann C Bonham. (2007). Air pollutants and cough. Pulm Pharmacol Ther. 20(4): 347-54
16. Qingling Zhang et al.(2015). Cough and environmental air pollution in China. Pulm Pharmacol Ther. 35: 132-6.
17. N Soldevila Bacardit et al. (2018). Air pollution, cardiovascular risk and hypertension. Hypertens Riesgo Vasc. 35(4): 77-184.
18. Bo-Yi Yang et al. (2018). Global association between ambient air pollution and blood pressure: A systematic review and meta-analysis. Environ Pollut. 235: 576-588.
19. Feifei Liu et al. (2019). Associations between long-term exposure to ambient air pollution and risk of type 2 diabetes mellitus: A systematic review and meta-analysis. Environ Pollut. 252: 1235-1245.
20. Yang M et al. (2020). Effects of long-term exposure to air pollution on the incidence of type 2 diabetes mellitus: a meta-analysis of cohort studies. Environ Sci Pollut Res Int.27(1): 798-811.
21. Rocha II et al. (2020). Impact of Air Pollution and Seasonal Haze on Neurological Conditions. Ann Acad Med Singap. 49(1): 26-36.
22. Andrew Shepherd et al. (2019). Arthritis diagnosis and early-life exposure to air pollution. Environ Pollut. 253: 1030-1037.
23. Chan CJ et al. (2012). Relationship between Air Pollution and Outpatient Visits for Nonspecific Conjunctivitis. Investig. Ophthalmol. Vis. Sci. 53: 429–433.
24. Rezakhani Jazani et al. Influence of traffic-related noise and air pollution on self-reported fatigue. Int J Occup Saf Ergon. 2015; 21(2): 193-200.
25. Bentayeb M, Helmer C, Raherison C, Dartigues JF, Tessier JF, Annesi-Maesano I. (2010). Bronchitis-like symptoms and proximity air pollution in French elderly. Respir Med. 104(6): 880–888.
26. Kumar R, Sharma M, Srivastva A, Thakur JS, Jindal SK, Parwana HK. (2004). Association of outdoor air pollution with chronic respiratory morbidity in an industrial town in northern India. Arch Environ Health. ;59: 471-7.
27. Jindal SK, Aggarwal AN, Gupta D, Agarwal R, Kumar R, Kaur T, Chaudhry K, Shah B. (2012). Indian study on epidemiology of asthma, respiratory symptoms and chronic bronchitis in adults (INSEARCH). Int J Tuberc Lung Dis. 16:1270-7.
28. Gronseth et al. (2014). Predictors of dyspnea prevalence: Results from the BOLD study. Eur Respir J. 43(6): 1610–1620.
29. Zhao CN et al. (2019). Emerging role of air pollution in autoimmune diseases. .Autoimmun Rev. 18(6): 607-614.
30. Giorgini P et al. (2016). Air Pollution Exposure and Blood Pressure: An Updated Review of the Literature. Curr Pharm Des. 22(1): 28-51.
31. Ikenna C. Eze. Et al. (2015). Association between Ambient Air Pollution and Diabetes Mellitus in Europe and North America: Systematic Review and Meta-Analysis. Environmental Health Perspectives.;123(5): 381-185.
32. Papazafiropoulou AK, Kardara MS, Pappas SI. (2011). Environmental pollution and diabetes mellitus. Recent Pat Biomark. 1: 44–48.
33. Nattero G, Enrico A. (1996) Outdoor pollution and headache. Headache. 36: 243–245.
34. Fu, Q. et al. (2017). Air pollution and outpatient visits for conjunctivitis: A case-crossover study in Hangzhou, China. Environ. Pollut. 231: 1344–1350.
35. Mieczysław Szyszkowicz et al. (2010). Air pollution and emergency department visits for chest pain and weakness in Edmonton, Canada, Brian Rowe. Int J Occup Med Environ Health. 23(1): 15-9.

CITATION OF THIS ARTICLE

P Kumar, S Gupta, S Asthana, J Batra.Impact of chronic exposure to air pollution on health of people of Delhi/NCR. Bull. Env.Pharmacol. Life Sci., Spl Issue [2]: 2022: 115-119