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Evaluation Of Lung Functions Exposed To Traffic Related Air Pollution Among Dental College Students

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Abstract :

Background : Air quality plays a significant role in human's health and wellbeing .Air pollution is a global problem and one of the most necessary environmental determinants for human fitness. Road transport is a major source of air pollution. Particulate matter, which is an important factor of air pollution, triggers an inflammatory response in lung tissues and bronchial epithelium(1).Traffic emission is an important source of ambient air pollution in urban regions . Numerous research has proven that persistent exposure to traffic-related air pollution used to be significantly related with respiratory mortality and morbidity(2). However, exposure to traffic emission frequently includes short-term (within hours) exposure to relatively excessive levels of traffic-related air pollution that leads to impaired lung functions.

Objective : The study aims to compare the lung functional status among non traffic related air pollution and traffic related air pollution exposed student population .

Methods : Few students who were constantly exposed to traffic related air pollution and students who were not exposed to traffic related air pollution were taken as the subjects for this study. The lung functional capacities (i.e) FVC,FEV1,PEFR,FEV1/FVC and FEF(25-75%) were determined using RMS Helios 702 spirometer. The data were analysed statistically using independent T- tests in SPSS version 23.The mean values and standard deviation of the mean (SD) were calculated for all the subjects.

Results :

The assessment of lung functions by FVC, FEV1 and FEF25-75 showed a decrease in TRAP exposed subjects compared to non TRAP exposed subjects but was not statistically significant. But FEV1/FVC & PEFR showed a statistically significant decrease in TRAP exposed subjects compared to non TRAP exposed subjects.

Conclusion :

This study indicated that the exposure to traffic related air pollution would enlarge the hazard of getting respiratory signs and symptoms and reduction in lung function amongst the study respondents . Thus the study concluded that students exposed to traffic related air pollution for more than a year had decreased lung

capacities and possessed an increased risk of obstructive lung disease like asthma .

Keywords : traffic related air pollution , air pollutants , reduced lung function .

INTRODUCTION

Air quality plays a significant role in human's health and wellbeing .Air pollution is a global problem and one of the most necessary environmental determinants for human fitness .The most essential process contributing to levels of ambient air pollution in urban settings relates to the combustion of fuels(3).Road transport is a major source of air pollution. Particulate matter, which is an important factor of air pollution, triggers an inflammatory response in lung tissues and bronchial epithelium(1).Traffic emission is an important source of ambient air pollution in urban regions(4) . Numerous research has proven that persistent exposure to traffic-related air pollution used to be significantly related with respiratory mortality and morbidity(2) . However, exposure to traffic emission frequently includes short-term (within hours) exposure to relatively excessive levels of traffic-related air pollution(5). Due to the proximity between human beings and sources, road traffic is mainly important for the population exposure to ambient air pollution in developed countries(6). TRAP has been proven to be a primary risk issue for cardiovascular disease, which includes hypertension. TRAP contributes significantly to outside air pollution, specifically in urban settings(7). Humans are particularly sensitive to air pollution, and there is increasing evidence that exposure to TRAP can also impact pregnancy outcomes and toddler development(8).Vehicle exhaust emissions may additionally lead to health risks particularly humans who are actively commuting(9).

Students who commute on or close to major roads and highways, whether or not in their personal vehicle, by using public transit, or via active transport, are exposed to greater concentrations of TRAP(9,10). In-vehicle concentrations of major air pollution which includes PM2.5 and NO2 are similar to on-road concentrations, each of which are significantly greater than concentrations measured at air monitoring stations eliminated from high traffic areas(11). Active transport, through walking or cycling, alongside major routes also leads to greater exposure to TRAP(12). Particulate matters such as PM10 and PM2.5 contain microscopic solid or small liquid droplets that can be inhaled and cause serious health(13) . Moreover, fine particulate matter PM 2, 5 micron enters the alveoli through inhalation and passes through into the systemic circulation inflicting a progressive inflammatory reaction, leading to cardiopulmonary diseases problems(14). NO2 gasoline is chiefly emitted in the air from the burning of fuels and also forms from emission from cars, lorries and buses, power plant life and off-road equipment(15). The acute effects of NO2 are respiratory airway inflammation and respiratory signs and symptoms such as
coughing, wheezing or difficulty in breathing(Kim et al. 2009)(16).The destructive outcomes of traffic associated air pollution on respiratory signs and symptoms and lung function in particularly highly exposed populations such as two wheelers , taxi drivers (17). The study aims to compare the lung functional status among non traffic related air pollution and traffic related air pollution exposed student population .

MATERIALS AND METHODS :

Healthy students in the age group of 18-20 both gender with similar anthropometric measurements participated in the studies. They were screened for medical history and physical conditions; the functional status of the respiratory system was assessed by a pulmonary function test using a

spirometer . ethical clearance was obtained from the institutional human ethical committee from all the subjects after explaining the experimental procedure . Exclusion criteria: Subjects with obesity, cardiorespiratory problems and those who were on medication for some reason or other were not included in the study.

They were divided into two groups.

Group 1 students exposed to traffic related pollution (TRAP)

Group 2 students staying in hostels with no TRAP exposure.

Few students who were constantly exposed to traffic related air pollution and students who were not exposed to traffic related air pollution were taken as the subjects for this study. the parameters studied were forced vital capacity (FVC), forced expiratory volume in 1st sec(FEV1), FEV1/FVC ratio represents the proportion of a person's vital capacity that they are able to expire in the first second of forced expiration (FEV1) to the full, forced vital capacity (FVC), FEV3/FVC ratio refers to the fraction of the forced vital capacity (FVC) that had not been expired during the first 3 s of the FVC, PEFR peak expiratory flow rate (PEFR), forced expiratory flow rate 25-75 (FEF25-75). All these parameters were recorded by a single breath technique . The lung functional capacities (i.e) FVC,FEV1,PEFR,FEV1/FVC and FEF(25-75%) were determined using RMS Helios 702 spirometer. The data were analysed statistically using independent T- tests in SPSS version 23.The mean values and standard deviation of the mean (SD) were calculated for all the subjects.

RESULTS :

The assessment of lung functions by FVC, FEV1 and FEF25-75 showed a decrease in TRAP exposed subjects compared to non TRAP exposed subjects but was not statistically significant. But FEV1/FVC & PEFR showed a statistically significant decrease in TRAP exposed subjects compared to non TRAP exposed subjects ($p<0.05$). A strong correlation was found between traffic related air pollution and the severity of airway obstruction and respiratory symptoms. (Table- 1)

Table 1 - Comparative evaluation of lung functions among TRAP and non TRAP in college students

LUNG FUNCTION PARAMETERS	TRAP EXPOSURE	NON TRAP EXPOSURE
FVC	2.32±0.773	3.02 + 0.640
FEV1	2.30±0.676	2.85 + 0.575
FEV1/ FVC	94.05±7.723	96.92 + 4.199
PEFR	4.86±1.041	7.11 + 2.236
FEF25-75	3.10±0.680	3.64 +1.804
FEV3/FVC	100.01±0.000	100.1 + 0.000

Values are expressed as ± mean standard deviation .

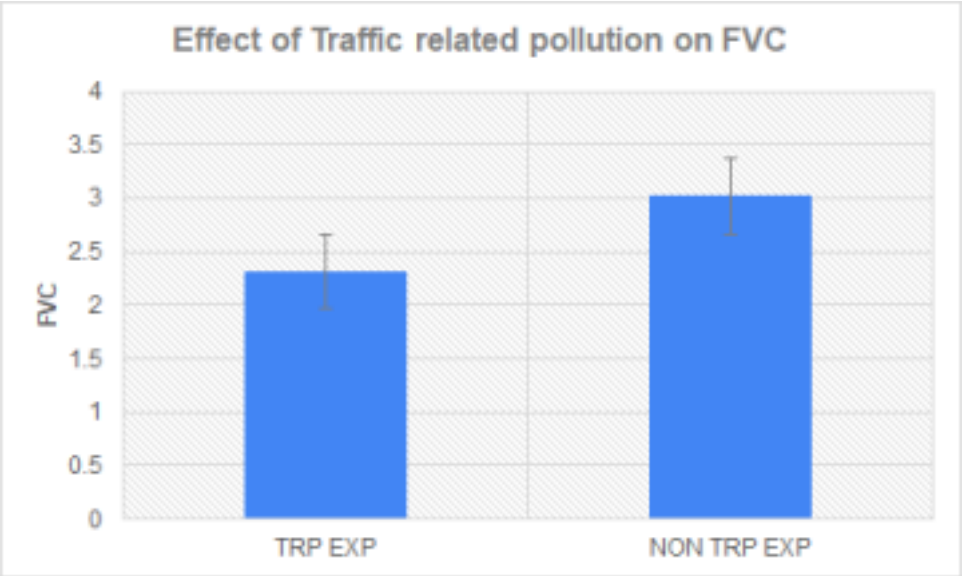

Fig 1 represents the changes in forced vital capacity among TRAP and non TRAP exposed students. Here the x axis represents FVC (forced vital capacity) and y axis represents TRAP and non TRAP exposed students. FVC showed a decrease in TRAP exposed subjects compared to non TRAP exposed subjects and independent-t test p value is 0.753 but was not statistically significant. ($p>0.05$).

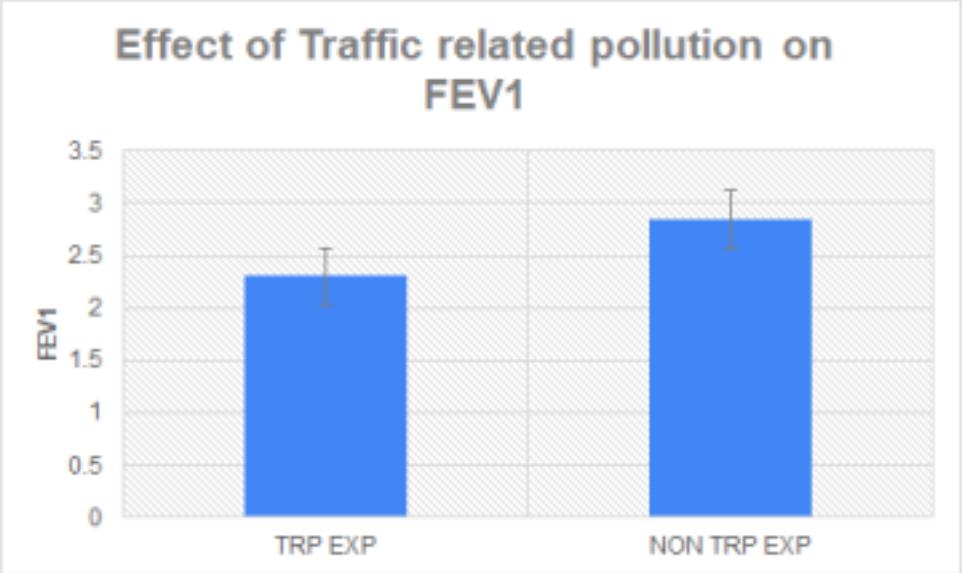

Fig 2 represents the changes in forced expiratory volume FEV1 among TRAP and non TRAP exposed students. Here the x axis represents FEVI (forced expiratory volume) and y axis represents TRAP and non TRAP exposed students. Forced expiratory volume in 1st sec
(FEV1) showed a decrease in TRAP exposed subjects compared to non TRAP exposed subjects and independent-t test p value is 0.987 but was not statistically significant ($p>0.05$).

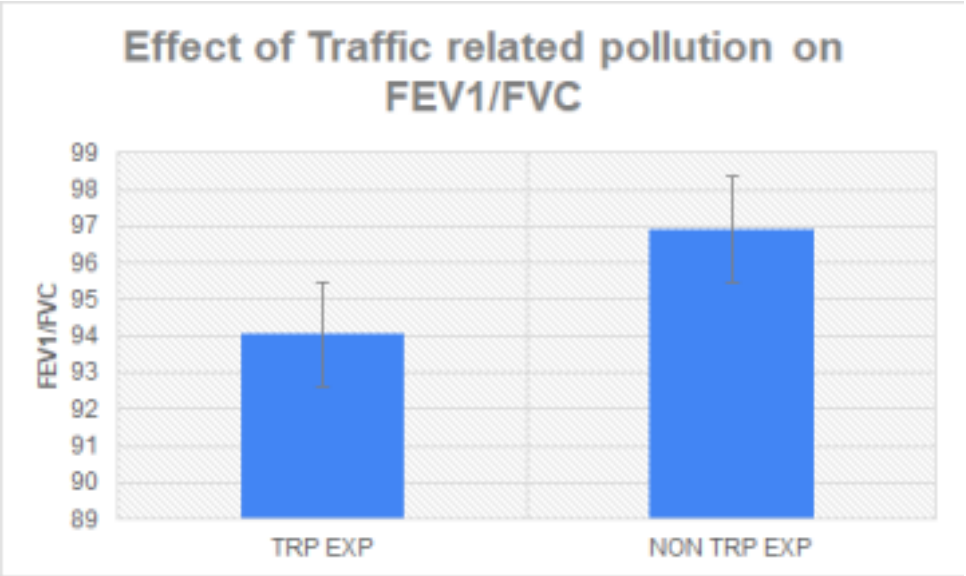

Fig 3 represents the changes in FEV1/FVC ratio among TRAP and non TRAP exposed students. Here the x axis represents FEV1/FVC ratio and y axis represents TRAP and non TRAP exposed students. FEV1/FVC showed a statistically significant decrease in TRAP exposed subjects compared to non TRAP exposed subjects and independent-t test p value is 0.056 ($p<0.05$)

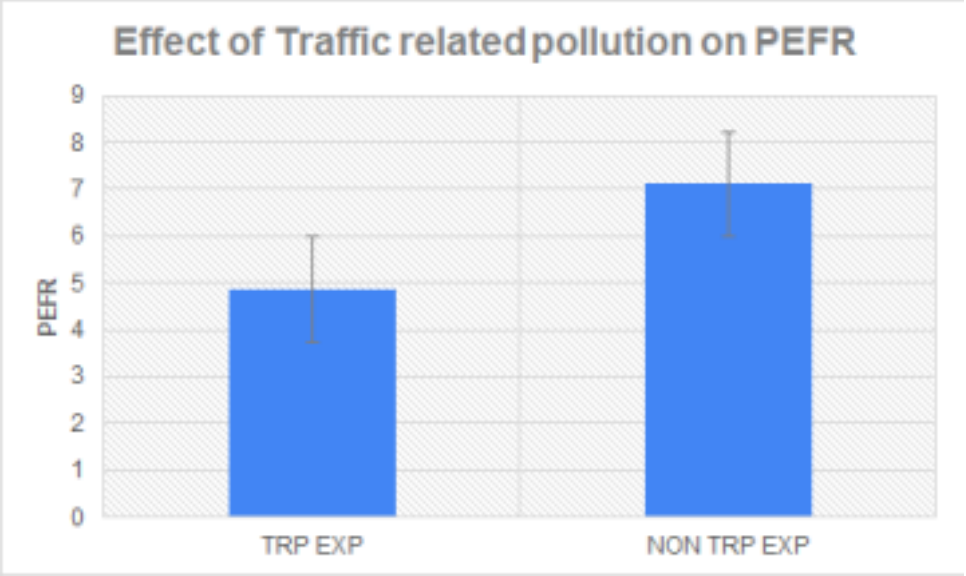

Fig 4 represents the changes in PEFR among TRAP and non TRAP exposed students . Here the x axis represents PEFR and y axis represents TRAP and non TRAP exposed students.

PEFR showed a statistically significant decrease in TRAP exposed subjects compared to non TRAP exposed subjects and independent-t test p value is 0.12 ($p>0.05$)

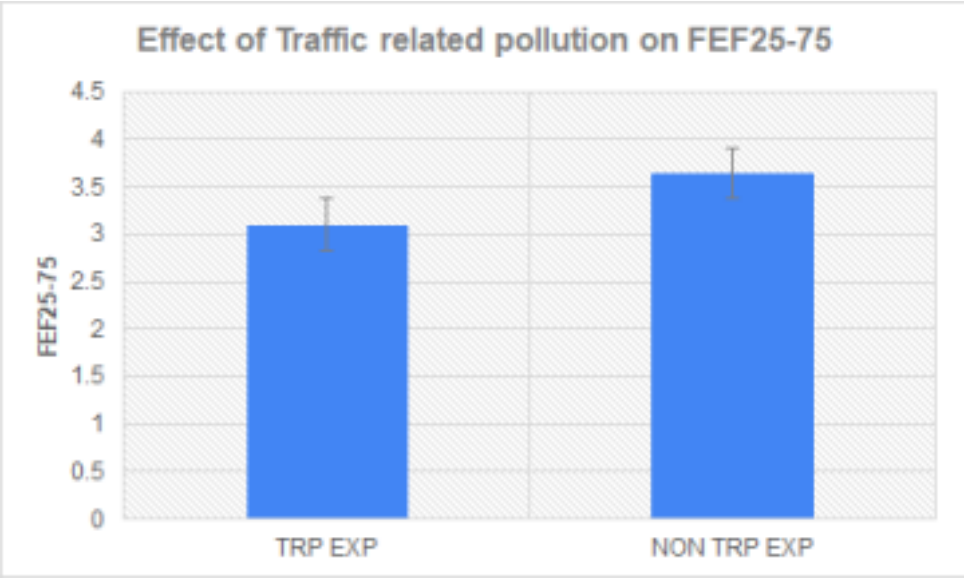

Fig 5 represents the changes in FEF25-75 among TRAP and non TRAP exposed students . Here the x axis represents FEF25-75 and the y axis represents TRAP and non TRAP exposed students. FEF25-75 showed a decrease in TRAP exposed subjects compared to non TRAP exposed subjects and independent -t test p value is 0.288 but was not statistically significant($p>0.05$).

DISCUSSION :

Air pollutants from traffic areas are important triggers for asthma exacerbations and studies relating the role of air pollutants as causative agents in the development of disease are not consistent(18).

Previous reports claim the role of short-term, that is time scales from days to months of TRAP exposure and respiratory health in adults had been the subject of multiple investigations(19). The present study showed a decline in lung functions as shown by a statistical significant decrease in FEV1/FVC and PEFR and a non-significant decrease in FVC, FEV1 & FEF25-75. This insignificance may be attributed to the lower sample size taken in the study(20).

Here PEFR is the highest level of pressure applied to the lungs during inhalation, decrease in PEFR may indicate asthma , chronic obstructive pulmonary disease(21)(22). FEV1/FVC represents the proportion of a person's vital capacity that they are able to expire in the first second of forced expiration (FEV1) to the full, forced vital capacity (FVC)(23).

Decrease in FEV1/FVC may indicate Asthma COPD, including chronic bronchitis, emphysema, and bronchiectasis (24)(25).

A study by Rice et al, 2015 found that living in less than 100 m from a major roads and increased Particulate matter <2.5 µm exposure were both associated with greater lung function decline (26). Previous report by Exposure to air pollution from traffic during the first year of life was associated with an excess risk of persistent wheezing(27,28)

Recent prospective studies also indicate that air pollution may impair lung function development at ages between 8 and 18 years, resulting in persistent damage.(29,30) A previous study by Swedish scientists revealed that there was a strong association between residential outdoor levels of locally emitted air pollution from traffic and 3 different indicators of airway disease like persistent wheezing, lower peak expiratory flow and sensitization to pollen(25,31). These cohort studies in children give some support for an association between traffic-related air pollution and airway disease (32,33)(34).

However, few studies have investigated the effects of long-term (over years to decades) TRAP exposure on asthma risk and reduced lung function. Components of TRAP, such as NO_2 and $PM_{2.5}$, cause oxidative stress and subsequent damage to the airways, leading to inflammation and lung remodelling.(35) (36)(37)

CONCLUSION :

This study indicated that the exposure to traffic related air pollution would enlarge the hazard of getting respiratory signs and symptoms and reduction in lung function amongst the study respondents . PM10 and PM2.5 were observed to be more significant with decreased lung function and respiratory signs and symptoms among the college students who go back and forth by means of two wheelers. Thus the study concluded that students exposed to traffic related air pollution for more than a year had decreased lung capacities and possessed an
increased risk of obstructive lung disease like asthma . Our study adds to the existing body of evidence that even low levels of TRAP exposure are associated with poor lung function even in healthy adults .

LIMITATIONS OF THE STUDY

The study population was confined only to a small group. If more sample size is added the results would have been statistically significant.

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AUTHOR CONTRIBUTIONS:

Ms.Kritheka : Literature search, survey, data collection, analysis, manuscript writing Dr. Sridevi.G : Study design, data verification, manuscript drafting

CONFLICTS OF INTEREST:

The authors declare that there are no conflicts of interest in the present study

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