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A Comparative Study of Pulmonary Function Tests of Roadside Vendors with Relation to Duration of Job

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Abstract

Background: Rapid industrial growth, globalization, and poor environmental conditions at work places have created a lot of health-related issues. The rising number of vehicles has sharply increased the level of air pollution in various cities of India. Air Pollution is now the fifth largest killer in India says newly released Findings of global Burden of Disease report. The presence of various particles and gases such as carbon dioxide, carbon monoxide, sulfur, benzene, lead, nitrogen dioxide, and nitric oxide from vehicular emission plays a vital role in the pathogenesis of respiratory diseases. There are many studies concluding that there was a considerable increased burden of respiratory morbidities and lowered lung functions in traffic policemen and petrol pump workers, indicating major burden on health facilities. Effects of pollutants on lung functions was analyzed by recording Forced Vital Capacity (FVC), forced expiratory volume in one second (FEV1) and FVC/FEV1 ratio. Authors could not find any study on roadside vendors to assess their lung functions with duration of job so this study was planned to fill in the lacuna. The aim is to study the Lung Functions of roadside vendors working for more than 5yrs along roadside to identify the prevalence of abnormalities in lung function tests and to corelate these abnormalities with their duration of job.

Material and Methods: It is a cross-sectional comparative study done in Department of Physiology of G R Medical College, Gwalior (M.P.) and SRVS Medical College Shivpuri (M.P.). We have included 90 roadside vendors and 90 age and sex matched controls in our study. According to Cambridge dictionary 'roadside vendors' are individuals who are working in shops or their temporary occupancy on edges of road. Computerized Spirometry software (MEDICAID SIPRO EXCEL) manufactured in Mohali, India, was used to assess FVC, FEV1 & FVC/FEV1 ratio. Statistical Analysis is unpaired Student t-test analysis will be done using GraphPad Prism, version 5.0 software. p value <0.05 will be considered as significant value and relation with duration of job was calculated using pearson-r.

Results: Roadside Vendors recorded a significant decline in all parameters, FVC, FEV1, and FVC/FEV1 ratio when compared with controls, and is probably due to exposure to vehicular pollution. On Comparing two subgroups of roadside vendors on basis of duration of job we found a significant decline in PFT parameters like FVC, FEV1, FEV1/FVC ratio, PEFR & FEF25-75%. Values of FVC (2.89L ± 0.46), FEV1 (2.46L ± 0.45), FVC/FEV1 ratio (84.17% ± 6.61), PEFR (4.11 ± 1.12) and FEF25-75% (3.4 ± 0.79) were significantly lower in subgroup B of roadside vendors who were working for more than 10 years than those obtained in subgroup of roadside vendors who were working for less than 10 years, in whom the values were 3.11 ± 0.35, 2.66 ± 0.36, 85.52 ± 7.42, 4.78 ± 1.71 and 4.0 ± 1.12 for FVC, FEV1, FVC/FEV1 ratio, PEFR and FEF25-75 , p-value of all parameters is <0.05 i.e., there is significant difference in the values. Also, all lung function tests parameters showed a negative correlation with duration of job as calculated by "pearson r" correlation.

Conclusion: In our study we found that all FVC, FEV1, FVC/FEV1 ratio, PEFR and FEF 25-75 were significantly lower in roadside vendors who are exposed for more than 10 years when compared to roadside vendors with a duration of exposure of 5-10 years. All PFT parameters showed a negative correlation with duration of job of roadside vendors. The effect of pollution by vehicular exhausts may be responsible for these pulmonary function impairments.

Keywords: Pulmonary function test, effects of pollution of PFT, PFT, PFT in roadside vendors, Effect of duration of exposure on PFT.

Introduction

Everyone has a particular lifestyle in which he/she lives and spends his daily time. This includes day to day behaviors, workplace environment, activities and diet.[1] According to WHO, 60% of related factors to individual health and quality of life are correlated to lifestyle.[2] Thousands of people follow an unhealthy lifestyle and thus they face its consequences in the form of illnesses, disabilities or even deaths. Problems like respiratory diseases, skeletal problems, cardiovascular diseases and so on, can be caused by an unhealthy lifestyle. Thus, we can say that to lead a healthy life one should follow a healthy lifestyle. We spend a major part of our life at our job workplace. In recent times, rapid industrial growth, globalization and poor environmental conditions at work places have created a lot of health-related issues. The rising number of vehicles has sharply increased the level of air pollution in various cities of India.[3,4] A health survey done in 2013 by the Centre for Science and Environment (CSE), New Delhi, has shown that 141 (80%) cities in India exceeds the PM 10 (pollutants that emit particulate matter of less than 10 micrometers in size) standard, 90 cities have a critical level of PM 10 and 26 cities have the most critical level, exceedingly thrice the standards, including Gwalior. Air pollution is now the fifth largest killer in India says newly released findings of CSE

report.[4] The presence of various particles and gases such as carbon dioxide, carbon monoxide, sulfur, benzene, lead, nitrogen dioxide, and nitric oxidefrom vehicular emission plays a vital role in the pathogenesis of respiratory diseases.[5,6] Evaluation of lung functions which includes measurement of Forced Vital Capacity (FVC), Forced Expiratory Volume in 1st second (FEV1), FEV1/FVC ratio, Maximum Voluntary Ventilation (MVV), Peak Expiratory Flow Rate (PEFR) is a very useful tool for assessing the effect of these pollutants over the human lungs.[7–10] There are many studies concluding that there is a considerable increased burden of respiratory morbidities and lowered lung functions compared to the expected values among traffic policemen,[11–15] and on petrol pump workers,[16–18] who are exposed to the vehicular pollution indicating major burden on health facilities. All of above studies have discussed effects that vehicular exhaust can cause on specific group of population, still there is a significant group of population that has been unnoticed till date, that include group of individuals that continuously work along roadside to sell their goods. Similar kind of pollution exposure is also expected to occur for these "roadside vendors" who work along the roadside for their daily living. Authors could not find any research study evaluating pulmonary function tests on these roadside vendors, despite similar environmental condition and possibility of exposure to motor vehicle emissions which may affect their lung functions. Hence, this study has been planned to fill this lacuna of information about pulmonary function tests in roadside vendors and tried to corelate the abnormalities of lung function tests with the duration of job of these roadside vendors.

Material and Methods

The study entitled "A Comparative Study of Pulmonary Function Tests of Roadside Vendors with Relation to Duration of Job" will be conducted in the Dept. of Physiology, G. R. Medical College and JA Group of Hospitals, Gwalior (M.P.)

Institutional Ethical committee approval was taken before commencement of the study.

Objectives of the study:

1. To determine the lung functions in roadside vendors using computerized spirometry.
2. To corelate lung functions of roadside vendors with duration of job

Duration of the Study: 2 years, December 2020 to November 2022

Sample Size: Total 180, 90 Normal healthy subjects and 90 roadside vendors working along roadside for more than 5yrs.

Considering 5% level of significance and 95% power of test anticipated standard deviation of PEFR among roadside vendors and control groups 1.84 L/min and 1.80 L/min respectively with 1 L/min mean difference among both groups (15).

Using the formula-

$$N = \frac{[S_1^2 + S_2^2] \times [Z_{\alpha/2} + Z_{1-\beta}]^2}{[X_1 - X_2]^2}$$

S_1 – 1.84L/min

S_2 – 1.80 L/min

$Z_{\alpha/2}$ – 1.96 (At 5% level of significance)

$Z_{1-\beta}$ – 1.64 (At 95% power of test)

$X_1 - X_2 = 1$

Study design: Non-invasive Cross-sectional study

Study population: Normal healthy individuals working along roadside for more than 5 yrs, 5 days a week and at least 6 hours a day of age group 20-55 yrs. We further divided roadside vendors into 2 sub-groups according to duration of job. We further divided roadside vendors on basis of duration of job into subgroup A (Duration of job of 5-10 years) and subgroup B (Duratio of job more than 10 years).

Control population: Age and sex matched individuals not working along roadside.

An informed consent was taken from every subject and control. Medical examination including detailed relevant medical, personal, family history was taken and filled on a separate proforma for each subject and control.

Computerized Spirometry software (MEDICAID SIPRO EXCEL) manufactured in Mohali, India, was used to perform Lung Function Tests.

According to Cambridge dictionary 'roadside vendors' are individuals who are working in shops or their temporary occupancy on edges of road.

Inclusion criteria

1. Study group: Non-smoking roadside vendors of 20-55 yrs. of age group working for 5 days a week and at least 6 hrs a day with duration of exposure more than 5 yrs. (19)
2. Control group: Age and sex matched healthy subjects who are not working along the roadside.

Exclusion criteria

- Subjects with past or current history of Respiratory disorders including Tuberculosis, Asthma, COPD
- Subjects with history of hospitalisation for cardiovascular event
- Subjects with no personal history of smoking
- Subjects with musculoskeletal deformity
- Irregular or seasonal roadside vendors (will be excluded from cases)

Lung Function tests

Lung functions tests were done using portable Spirometer, Spiro excel machine. Computerized Spirometry software (MEDICAID SIPRO EXCEL) was used to measure Lung Functions. The logic built into the Spiro Excel evaluates the subject as an adult or child, male or female and selected the suitable set of equation for computation of predicted norms.

Technical Features Spiro Excel Machine

Flowmeter	**Bi-directional digital turbine**
Range for flow measurement	0.03 - 20 L/s
Range for volume measurement	10L
Accuracy of measurement	3% or 50ml
Dynamic resistance @ 12L/s	< 0.7 cm of H2O/L/s
Mouth pieces	31 & 21mm
Power supply	No external supply required, works on 5V from CPU
Dimensions	160 x 50 x 25 mm
Weight	100gm

The following parameters of each subject were recorded by the portable spirometer:

1. Forced vital capacity (FVC)
- FEV1
- FEV1/FVC
- PEFR

2. Slow vital capacity (SVC)
3. Maximum voluntary ventilation (MVV)

Measures taken before lung function tests were performed:

1. Spirometer calibration was checked.
2. Subjects were properly explained abouts the tests to be performed by them.
3. Hand hygiene was performed before the start of the test.
4. Instructions and demonstrations were given to the subjects.

Statistical Analysis:

Statistical analysis to compare the two study groups was done by student's t-test using Graph Pad Prism software.

S.No.	**Parameters**	**Mean ± SD**		**p-value**
		Roadside Vendors (n=90)	**Control Group (n=90)**	
01	Age (years)	36.31 ± 5.26	38.14 ± 4.5	0.11
02	Height (cm)	161.7 ± 4.59	162.7 ± 4.19	0.14
03	Weight (Kg)	64.02 ± 3.37	64.81 ± 4.01	0.15

Results

In our study we found that our study group and control group are age, sex, weight and height matched, these results are shown in Table-1. The average duration of exposure of roadside vendors to pollution exposed workplace is 10.18 years.

Spirometry findings: Spirometry findings are summarized in [Table3].

Table 3: Forced Vital Capacity, Slow Vital Capacity & Maximum Voluntary Ventilation of Roadside Vendors and Control Group

S. No.	Parameter	Mean ± SD		p-value
		Roadside Vendors (n=90)	Control Group (n=90)	
01	FVC (L)	3.01 ± 0.42	4.07 ± 0.21	<0.001*
02	SVC (L)	2.48 ± 0.89	4.19 ± 0.43	<0.001*
03	FEV1 (L)	2.57 ± 0.41	3.69 ± 0.59	<0.001*
04	FEV1/FVC (%)	84.94 ± 7.07	89.15 ± 2.79	<0.001*
05	MVV (L/min)	72.19 ± 15.05	124.5 ± 10.94	<0.001*
06	PEFR (L/s)	4.49 ± 1.51	9.29 ± 0.93	<0.001*
07	FEF 25-75 L/s	3.77 ± 1.02	6.11 ± 0.51	<0.001*

All spirometry parameters showed significant difference between two study groups in which roadside vendors showed significantly lower values when compared to control group.

Observation And Results of Two Subgroups of Roadside Vendors

We have further subdivided our study population of roadside vendors in two sub-groups (Group-A & Group-B) to study the effect of duration of exposure to air pollution at their work place and its effect on lung function tests.

- Group-A- Roadside Vendors who are working along the roadside for a duration between 5-10 years.
- Group-B- Roadside Vendors who are working along the roadside for a duration of ≥ 10 years.

Table4: Anthropometric Parameters of Two Sub-groups of Roadside Vendors

S.No.	Parameters	Mean ± SD		p-value
		Group-A (n=51)	Group-B (n=39)	
01	Age (years)	38.47 ± 5.45	40.41 ± 4.84	0.08
02	Height (cm)	161.6 ± 4.74	161.8 ± 4.45	0.86
03	Weight (Kg)	63.94 ± 3.17	64.13 ± 3.65	0.79
04	BMI (Kg/m2)	24.53 ± 1.77	24.55 ± 1.94	0.95

Group-A- Roadside Vendors who are working along the roadside for a duration between 5-10 years
Group-B- Roadside Vendors who are working along the roadside for a duration of ≥ 10 years
So, from above Table-4 we can say that our study population's subgroup A & B are age, height, weight and BMI matched since they do not show any significant difference in their p-value.

Table 5: General Characteristic Parameters of Two Sub-groups of Roadside Vendors

S.No.	Parameters	Mean ± SD		p-value
		Group-A (n=51)	Group-B (n=39)	
01	Duration Of Job (yrs)	7.80 ± 0.93	13.31 ± 2.68	<0.001*
02	Pulse (per min.)	86.47 ± 6.3	88.46 ± 4.7	0.10
03	S.B.P (mmHg)	131.3 ± 3.53	131.4 ± 3.73	0.86
04	D.B.P. (mmHg)	83.14 ± 4.21	84.36 ± 4.69	0.19
05	Respiratory Rate (per min)	18.33 ± 1.70	18.41 ± 2.16	0.85
06	Working Hours/day	9.37 ± 1.07	9.79 ± 1.10	0.07

So, from [Table5] we can say that there is no significant difference in systolic blood pressure, diastolic blood pressure, respiratory rate and working hours per day between Group-A and Group-B roadside vendors with a p-value of more than 0.05. While duration of job showed significant differences with p-value less than 0.05.

Lung Function Tests of Two Sub-groups of Roadside Vendors

Table 6: Lung function tests of two sub-groups of roadside vendors.

S.No.	Parameters	Mean ± SD		p-value
		Group-A(N=51)	Group-B(N=39)	
01	FVC (L)	3.11 ± 0.35	2.89 ± 0.46	0.01*
02	SVC (L)	2.47 ± 0.95	2.50 ± 0.82	0.89
03	MVV (L/min)	60.24 ± 12.92	58.36 ± 11.49	0.37
04	FEV1 (L)	2.66 ± 0.36	2.46 ± 0.45	0.02*
05	FEV1/FVC (%)	85.52 ± 7.42	84.17 ± 6.61	0.03*

06	PEFR (L/s)	4.78 ± 1.71	4.11 ± 1.12	0.03*
07	FEF 25-75 L/s	4 ± 1.12	3.4 ± 0.79	0.01*

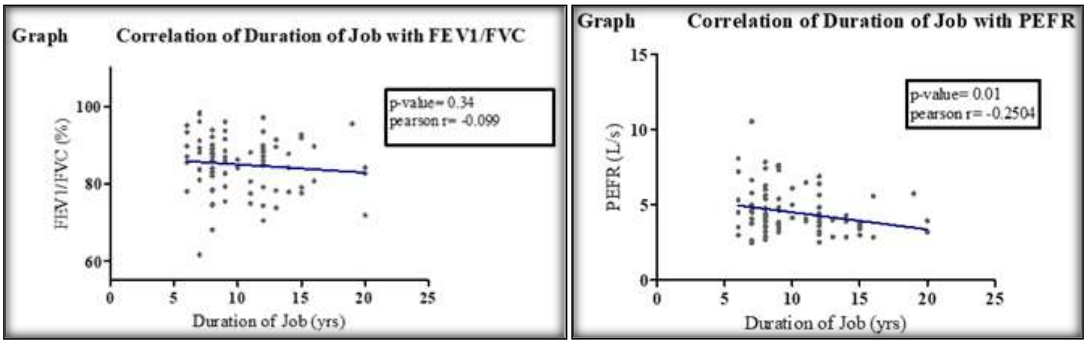
Group-A- Roadside Vendors who are working along the roadside for a duration between 5-10 years
Group-B- Roadside Vendors who are working along the roadside for a duration of ≥ 10 years
*- signifies significant difference having p-value<0.05.

Table 7: Correlation Test with Duration of Job of Roadside Vendors

S.No.	Parameter	p-value	Pearson r
01	FVC (L)	0.002*	-0.3138
02	SVC (L)	0.87	0.01711
03	FEV1 (L)	0.03*	-0.2234
04	FEV1/FVC (%)	0.34	-0.09977
05	MVV (L/min)	0.06	-0.1959
06	PEFR (L/s)	0.01*	-0.2504
07	FEF 25-75 L/s	0.005*	-0.2933

*- signifies significant difference having p-value<0.05.

We calculated correlation with duration of job, from above Table-7 we found that as duration of job of roadside vendors is increasing there is a significant decline in values of FVC, FEV1, PEFR and FEF 25-75, all these parameters have p-value less than 0.05 and "pearson r" shows a negative correlation. We did not find a significant decline in SVC, MVV and FEV1/FVC ratio as they have p-value more than 0.05, still MVV and FEV1/FVC ratio do have a negative correlation with duration of job as "pearson r" is having a negative value of -0.1959 and -0.09977 respectively.



Discussion

Nature always maintains a balance between land, water, air and all living organisms in world. If left on its own, nature will thrive fruitfully this was also seen during covid lockdowns when all industries and vehicles came to halt nature healed almost all rivers and air quality towards normal. Humans due to their rapid evolution have created serious imbalance in nature's ecosystem and this has started to affects their own health in a negative way.Rapid industrialization, urbanization, use of vehicles are the major causes of environmental pollution in the world. Experimental studies indicate that due to airborne contaminants of diesel fumes, changes in PFTs are seen due to injury to airways and parenchyma in subjects who are exposed to it, because lungs are the major site of contact between the body and the environment, they are one of the first organ to be affected in our body.The population of roadside vendors is susceptible for air pollution exposure as most of the time they are busy on the roads and are exposed to automobile exhaust and other air pollutants. Exposure to air pollutants over a long period is said to have deleterious effects on the respiratory functions of roadside vendors. In our present study estimation of various lung parameters like FVC, FEV1, FEV1/FVC, FEF 25-75%, PEF and SVC were done using digital Medicaid Spiro-excel spirometer among roadside vendors of age 20-55 years who were non-smokers and these parameters were compared with age and sex matched road side vendors with longer duration of exposure by dividing these into two subgroups. Further, we tried to calculate correlation of these parameters with the duration of their job among roadside vendors.

FVC, SVC & MVV: We observed that all capacities of lung i.e., FVC, SVC and MVV of roadside vendors is significantly lower than that of control group (Normal healthy subjects). While comparing two sub-groups of roadside vendors we found that FVC showed a significantly lower p-value in sub-group B who had longer duration of exposure. SVC and MVV did not showed a significant difference between two subgroups.We also corelated duration of exposure to air pollution with FVC, SVC and MVV, it shows that all above parameters are negatively correlated with duration of exposure, but only FVC shows statistically significant negative

correlation with a p-value of 0.002 and pearson r of -0.3138. This means that with increase in duration of exposure FVC decreases more causing impairment in lung function [Table7]. Indicating a more restrictive pattern of pathology in lungs.Similar results were also seen in a study conducted in Pune city by Gavali et al. (2012) which showed reduction in FVC functions in auto drivers which depicted restrictive type of lung impairment when compared to control group.[20]Vehicular exhaust particles have size < 0.1 micrometer by releasing reactive oxygen species produces inflammation in the lungs and affects its function. Diesel exhaust particulate constitutes a large proportion of the PM in ambient air. In particular, diesel exhaust fumes cause bronchoconstriction, neutrophilic inflammation and dysfunction of alveolar phagocytosis together with histamine release from mast cell in healthy individuals.Human lung parenchyma retains PM of <2.5 (so these are also called "Respiratory PM"). PM is a highly toxic material because of its small size chemical composition, as suggested by the influx of inflammatory leukocytes into the airspace. PM has a variety of effect on lung defenses. Transition metals contained in PM, particularly iron, damage the airways by generating free radicals and stress (21). Important cells involved in the initial inflammatory responses to foreign particles are the macrophages and induces oxidative stress in these cells. Therefore, chronic exposure to these particles can lead to inflammation of respiratory tract and lung parenchyma. Thus, it can contribute to substantial decrease in lung functions.[21]

FEV1: We observed that FEV1 of roadside vendors to be significantly lower when compared to control group, with a mean value of 2.57 L ± 0.41 and 3.69 L ± 0.59 respectively, and this difference is statistically highly significant with a p-value of <0.001.On Comparing two subgroups of roadside vendors we found that subgroup B had a significantly lower FEV1 with p-value less than 0.05, with a mean value of 2.46 L ± 0.45 while subgroup A have mean FEV1 of 2.66 L ± 0.36.On corelating the duration of exposure with respect to FEV1 by calculating pearson r we found that it had a significant p value of 0.03, and had a negative correlation with duration of job.Similar results were found in a study done by Nair GB et al (2014) in petrol pump workers in Kerala who compared FEV1 of these petrol pump workers with normal healthy individuals as control group they found that FEV1 was significantly lower in petrol pump workers when compared to control group.[22]

FEV1/FVC ratio: We observed that FEV1/FVC ratio in roadside vendors is 84.94% ± 7.07 whereas of control group is 89.15% ± 2.79 this shows that FEV1/FVC ratio is significantly lower in roadside vendors when compared to control group with a p-value of <0.001, however both sets of results are within normal range i.e., if FEV1/FVC ratio is considered to be normal if the value is above 80% and thus our both case and controls have normal FEV1/FVC ratio.[23]On comparing two subgroups of roadside vendors we found that subgroup B had a significantly lower FEV1/FVC ratio with p-value less than 0.05 having a mean value of 84.17 ± 6.61, while subgroup B have a mean FEV1/FVC ratio of 85.52 ± 7.42.We observed that there is a negative correlation of FEV1/FVC ratio with duration of job of roadside vendors with pearson r of -0.099 but this relation is not statistically significant. Similar results were seen in a study done by Pakkala et al (2013) in Chittoor district who compared lung functions of pollution exposed sportspersons and control groups. They found FEV1/FVC ratio significantly lower in sportspersons, where pollution exposed sports person has FEV1/FVC ratio of 76%.[24]
A study was done by Raina V et al. (2014) who compared pulmonary function tests in traffic police personnel and normal control groups in Jammu region. In their study they did not find any significant decline in FEV1/FVC in traffic police personnel when compared to control group, however in their study FVC, FEV1, PEFR was found to be statistically significantly reduced in traffic police personnel.[25]

PEFR: We observed that there is significant difference in PEFR of roadside vendors and control group where roadside vendors have PEFR of 4.49 L/s ± 1.51 and control group have PEFR of 9.29 L/s ± 0.93. On comparing Percentage Predicted of PEFR of roadside vendors and control group percentage predicted of PEFR of roadside vendors is 54% ± 17.56 whereas that of control group is 107.5% ± 11.72, and this difference is statistically significant. Decreased PEFR means that peak flow rate is reduced of airflow. On comparing the two subgroups of roadside vendors we found that subgroup B had a significantly lower PEFR with a mean value of 4.11 L/s ± 1.12 when compared to subgroup A with a mean PEFR of 4.78 L/s ± 1.71.On corelating the duration of job with PEFR by pearson r we founds its p-value to be statistically significant and pearson r showed a negative correlation with the duration.

FEF 25-75%:FEF 25-75% of roadside vendors is 3.77 L/s ± 1.02 while that of control group is 6.11 L/s ± 0.51 and this difference is statistically significant where roadside vendors have significantly lower FEF25-75%.
On comparing the two subgroups of roadside vendors we found that FEF 25-75% was significantly lower in subgroup B with a mean FEF 25-75% of 3.4 L/s ± 0.79 when compared to subgrop A with a mean FEF 25=75% of 4 L/s ± 1.12.Similar results were seen in a study done by Binawara BK et al. (2010) who compared pulmonary function tests of taxi drivers with normal control group. They found that FVC, PEFR and FEF25-75% all were significantly lower in taxi drivers when compared to control group.[26]We found that almost all the

pulmonary function tests parameters are negatively correlated with duration of job of roadside vendors as almost all of them except SVC have a negative value of pearson r. Out of these FVC, FEV1, PEFR, FEF25-75% have significant correlation with duration of job as their p-value is <0.05. It is also important to note here that p-value and pearson r of FVC is most significant out of all parameters, indicating that restrictive pathology of lungs is major pathological finding which is then superimposed by obstructive pathology also. [Table6]Our findings are similar to a study conducted by Ibrahim Farooque et al. (2014), who compared pulmonary function tests in non-smoking auto rickshaw drivers and healthy controls in Kerala. They found that all the lung function parameters were reduced significantly in the auto rickshaw drivers as compared to control subjects in the same age group and socio-economic status. They concluded that pulmonary function tests of auto rickshaw drivers who had worked for more than 10 years were more affected than those who had worked for less than 10 years. Majority of their subjects were found to have mixed obstructive and restrictive lung impairment.[27]Similarly, a study conducted by Naik et al (2014), who compared pulmonary function tests of traffic police personnel and control groups in Kashmir. They concluded that traffic police personnel have significantly lower lung function parameters when compared to control groups and these differences are more pronounced if duration of job of traffic police personnel is of more than 10 years. FVC and FEV1 were more affected in traffic police personnel who are working for more than 10 years and are indicating a mixed pattern of disease.[28]Similar results were seen in a study conducted by Paul V et al. (2021) who conducted a study to compare pulmonary function tests of traffic police personnel with normal control group in Mangalore. They concluded that as years of service is increasing in traffic police personnel their lung function parameters are declining further and out of these most affected parameters are FVC and FEV1.[29]Along with particulate matter pollutants, SO2 and NO2 have a greater chance to reach the deeper parts of the lungs. The properties and concentration of surfactant are altered by these gaseous pollutants and may thus contribute to the early closure of smaller airways. Most of the terminal bronchioles may be compromised before other pulmonary function tests such as FEV1 are affected. Histopathological studies have showed evidence that the smaller airways are the major site of damage in persons living in areas of high air pollution. Diesel exhaust generates particles are extremely small which is of size 0.02-0.2 nanometer. These small sized particles with their greater surface area can carry much larger fraction of hydrocarbons and metals on their surface which are toxic compounds. Moreover, they remain in the air for the longer period of time and they also get deposited in lungs in greater amounts than larger sized particles.[21]

Conclusion

Pulmonary function parameters of 90 non-smoking roadside vendors who were working for more than 5 years were compared with age matched 90 healthy controls. Out of 90 roadside vendors 51 were in subgroup A having a job duration of 5-10 years and 39 were in subgroup B with a duration of job more than 10 years.

From the present study it was concluded:

- The Roadside vendors were having a significantly reduced respiratory parameters like FVC, FEV1, FEV1/FVC, PEFR, FEF25-75%, SVC and MVV when compared with control groups whose age, weight and height are matched.
- There was significant difference in the above values depicting the restrictive type pattern of lung functions alone in roadside vendors who are working for less than 10 years.
- In roadside vendors who are working for more than 10 years obstructive pattern of lung function was also observed along with restrictive lung function.
- Also, it was observed that roadside vendors who were working for more than 10 years have their respiratory function parameter FVC, FEV1, FEV1/FVC ratio, PEFR and FEF 25-75% affected more when compared with those who were working less than 10 years.
- All lung function tests parameters showed a negative correlation with duration of job.

To the best of our knowledge this is the first study of its kind in which roadside vendors have been evaluated for pulmonary function tests. There are many studies that have evaluated pulmonary function tests on traffic police personnel, auto rickshaw drivers & taxi/bus drivers but no one has evaluated the effect of the automobile exhaust/pollution on roadside vendors.Hence this study proves that the effect of traffic pollution is not only over any specified group of population but on all the possible groups that are exposed to traffic pollution like roadside vendors. The effects of traffic pollution are almost similar as observed in previous studies conducted on other groups of population i.e., restrictive type of lung impairment for low duration of exposure to traffic pollution which is then superimposed with obstructive pattern of pathology on prolonged exposure.

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