A COMPARATIVE STUDY OF PULMONARY FUNCTION AND EOSINOPHIL COUNT IN PETROL PUMP WORKERS IN KAMRUP METRO DISTRICT IN RELATION TO CHRONIC INHALATION OF PETROLEUM DERIVATIVES

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ABSTRACT

Background: Workers in the petrol pump stations are chronically exposed to petroleum derivatives which have adverse effects on respiratory and haematopoetic system causing bone marrow depression. Aims & Objective: To study the Pulmonary function and Eosinophil count amongst petrol pump workers who are chronically exposed to the hazards of petroleum derivatives and to compare with that of controls. Materials & Methods: This cross-sectional study was carried out on 50 healthy non-smoker male petrol pump workers in Kamrup district who were compared with healthy controls. Medspiror digital expirograph was used to measure PFT and Eosinophil count estimation was done using Haemocytometry. Results: The mean values of FVC, FEV1, FEF25-75%, PEFR and Eosinophil count were reduced significantly in the study group (p<0.001 & p<0.05). Conclusion: This study has suggested that chronic exposure to petroleum derivatives had toxic effects on respiratory and haematopoetic system causing decrease lung function and reduced cell count.

INTRODUCTION

Hazardous exposures in the workplace and elsewhere in the environment continue to contribute to the burden of lung diseases and haematological abnormalities. Most respiratory diseases, including asthma, chronic obstructive pulmonary disease (COPD), interstitial lung disease and lung cancer may be caused or exacerbated by factors in the workplace[14]. According to the International Labor Organization (ILO), between 1.9 and 2.3 million people are killed by their work every year (including 12,000 children) and 25 million people have workplace injuries, causing them to take time off[6].

The rapid urbanization in India has resulted in a tremendous increase in the number of motor vehicles[20]. In Kamrup metro district, number of motor vehicles registered increases from 9945 in the year 2009-10 to 11343 in 2010-11[10]. This has led to an increase in petrol pump stations and petrol pump workers and also exposure of petrol pump workers to vapours of petrol and gases from exhaust of automobiles[1].

Sources of petroleum vapours at the petrol pump include losses from underground tank, displacement vapour losses from filler pipes during refueling, fuel spillage and evaporative emission from motor vehicles.

Petrol is a complex combination of hydrocarbons. About 95% of the components in petrol vapour are aliphatic and acyclic compounds[13]. While diesel fuel is a distillate of petroleum which contains paraffin, alkenes and aromatics[8]. Benzene and toluene are major monocyclic hydrocarbons in petrol with nitropyrene in derivatives and to compare with that of controls. Materials & Methods: This cross-sectional study was carried out on 50 healthy non-smoker male petrol pump workers in Kamrup district who were compared with healthy controls. Medspiror digital expirograph was used to measure PFT and Eosinophil count estimation was done using Haemocytometry. Results: The mean values of FVC, FEV1, FEF25-75%, PEFR and Eosinophil count were reduced significantly in the study group (p<0.001 & p<0.05). Conclusion: This study has suggested that chronic exposure to petroleum derivatives had toxic effects on respiratory and haematopoetic system causing decrease lung function and reduced cell count.

Hence the present study was undertaken to assess the extent of damage caused by the chronic inhalation of petrol fumes on the pulmonary and haematopoetic systems of petrol pump workers.

MATERIALS AND METHODS

This cross sectional study was carried out on 50 petrol pump workers who worked for more than 5 years in petrol filling stations across the Kamrup district (Study group) and 50 healthy individuals (Control group) from nearby areas who are not directly exposed to petroleum derivatives.

Inclusion criteria common to both the groups
1. Age group of 20-40 years.
2. Healthy nonsmoking male with no previous history of any major respiratory or other significant illness.
3. No anatomical deformity of chest or spine.

Exclusion criteria common to both the groups
1. Subjects with known respiratory diseases like bronchial asthma, bronchitis, pulmonary tuberculosis, emphysema etc.
2. Subjects with known cardiovascular diseases
3. Subjects with skeletal deformity of chest and thoracic vertebra
4. Subjects who are chronic smoker
5. Subjects where Pulmonary Function Test is contraindicated

Scheme of study: A proforma consisting of the necessary queries regarding the subject and the study concerned was given to each individual under the study to be filled up. Ethical clearance has been obtained from the authority and written informed consent was taken from the subjects. The study was conducted between 10AM – 4PM of the day due to heavy traffic during that period.

Recording of Lung Function was carried out by using an expirograph ( Medspiror- Med systems Pvt. Ltd, Chandigarh, India). Parameters recorded are FVC, FEV1, FEV1/FVC%, FEF25-75%, PEFR.

Absolute Eosinophil Count was done by using haemocytometry (Direct Method) with Improved Neubauer’s counting chamber.
Statistical analysis: The data collected were presented as the Mean ± Standard Deviation for each of the parameter. The two groups were compared by using unpaired 't'test and p value of less than 0.05 is be considered significant.

RESULTS AND DISCUSSION
The results obtained were tabulated and means of the recorded parameters were calculated, which are presented in the tables.

TABLE 1: COMPARISON OF DIFFERENT PARAMETERS OF PFT BETWEEN STUDY AND CONTROL GROUP

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>STUDY GROUP (MEAN±SD)</th>
<th>CONTROL GROUP (MEAN±SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (ltrs)</td>
<td>3.15±0.32</td>
<td>3.43±0.32</td>
<td>p&lt;0.001, VHS</td>
</tr>
<tr>
<td>FEV₁ (ltrs)</td>
<td>2.65±0.30</td>
<td>2.80±0.25</td>
<td>p&lt;0.001, VHS</td>
</tr>
<tr>
<td>FEV₁/FVC (%)</td>
<td>84.9±7.90</td>
<td>82.0±6.45</td>
<td>p&gt;0.05, NS</td>
</tr>
<tr>
<td>FEF₂₅₋₇₅ (ltrs/s)</td>
<td>3.71±0.29</td>
<td>3.91±0.39</td>
<td>p&lt;0.01, HS</td>
</tr>
<tr>
<td>PEF (ltrs/m)</td>
<td>559.80±15.45</td>
<td>467.38±17.93</td>
<td>p&lt;0.001, VHS</td>
</tr>
</tbody>
</table>

VHS: Very Highly Significant; NS: Non Significant; HS: Highly Significant

TABLE 2: COMPARISON OF EOSINOPHIL COUNT BETWEEN THE TWO GROUPS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>STUDY GROUP (MEAN±SD)</th>
<th>CONTROL GROUP (MEAN±SD)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEC (/cumm)</td>
<td>238.33±60.62</td>
<td>262.50±52.81</td>
<td>p&lt;0.05, Significant</td>
</tr>
</tbody>
</table>

Figure 1: Diagram showing Mean and SD values of FVC, FEV₁, and FEF₂₅₋₇₅%

Figure 2: Diagram showing Mean and SD values of FEV₁/FVC and PEF

Table 1 shows the Mean and SD values of FVC, FEV₁, FEV₁/FVC, FEF₂₅₋₇₅% and PEF between the Study and Control group in relation to chronic exposure. By applying Student's unpaired t-test we observed that Mean values of FVC, FEV₁ and FEF₂₅₋₇₅%, PEF were significantly reduced (p<0.001) in Study Group (duration > 5 years) in comparison to Control group. No significant difference (p>0.05) were observed in mean values of FEV₁/FVC between the two Groups.

Table 2 shows the values of AEC in both the groups where AEC is significantly lower (p<0.05) in Study group.

DISCUSSION
In the present study we found that all the lung volumes and Eosinophil count were decreased in petrol pump workers when compared to control group.

The significant reduction of FVC and FEV₁ in the study group as compared to the control group with no significant change in the ratio of FEV₁/FVC between the study and control groups suggest restrictive pattern of lung involvement.

On the other hand significant reduction of AEC in the petrol pump workers with more than 5 years duration can be attributed to the chronic exposure of benzene, which is used as an anti knocking agent in petrol, causes bone marrow suppression and haematotoxicity.

The results of this study are consistent with the earlier studies related to pulmonary function test and Eosinophil count with occupational exposure to petrolderivatives.

Rittika Singh[19] in 2013 in her research paper “Effect of petrol and diesel fumes on pulmonary functions in fuel pump workers” conducted a study on 50 non-smoker petrol pump workers of Mangalore with duration of service more than 1 year and 50 age matched healthy individuals. She also found statistically significant reduction in the values of FVC (L), FEV₁ (L), and FEF₂₅₋₇₅% among petrol pump workers as compared to control and also exposure-wise denotes prevalence of restrictive type of lung diseases.

The lung functions of 133 subjects (33 controls and 100 petrol pump workers) were studied by Neena Sharma et al[15] (2012) in “Ventilatory impairment in petrol pump workers” . The study showed a significant decline in the values of FVC, FEV₁, MVM among petrol filling workers when compared to controls. There was progressive decline in lung function with increase in duration of exposure.

Arpana Bhide et al[3] in 2014, found in their study of pulmonary function on petrol pump workers statistically significant decrease in the values...
of TV, FVC, FEV1, PEFR, 25% and MVV in petrol pump workers who have worked for more than 5 years compared to control group. The result shows statistically significant decrease in petrol pump workers exposed to benzene more than 15 years. But there was initial rise in eosinophil count in the study group when the duration of exposure was less than 10 years. The count decreases as the duration of exposure increases. T. Tunsaringkarn et al.[22] conducted a study in 2013 and reported that exposure to benzene causes bone marrow depression presenting as drop in haemoglobin, haematocrit and eosinophil counts and also reported that as the duration of exposure increases, eosinophil count increases and as the duration of exposure increases eosinophil count decreases, the lower of eosinophil count in those with duration of exposure more may due to suppression of bone marrow on bone marrow.

Petroleum hydrocarbons led to significant increase in lung tissue malondialdehyde (MDA) which increases lipid peroxidation and free radicals[17]. The antioxidant enzymes super oxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) serve as a primary line of defense in destroying the free radicals produced by oxidative stress.

Studies have reported that exposure to petroleum hydrocarbons impairs type II pneumocytes resulting in a decreased production of surfactant and consequent alveolar collapse, ventilation-perfusion mismatch and hypoxemia. This ultimately leads to haemorrhagic alveolitis, interstitial inflammation, intra-alveolar haemorrhage, oedema, hyperemia, bronchovascular necrosis contributing early closure of small airways[9,18]. Benzene exposure was found to induce the expression of p53, an interlocking control device for cell cycle, due to p53 up regulation, thereby inducing the immediate suppression of the kinetics of hematopoietic progenitors followed by the prominent suppression of hematopoiesis[24].

CONCLUSION

Occupational environment plays a major role on the health of those exposed to pollutants. Petrol pump workers by virtue of their work are exposed to petrol and diesel fumes, which may worsen lung function and the haemopoietic system.

In the present study the dynamic lung volumes and capacities like FVC, FEV1, PEFR, EF25-75% were significantly lower in petrol pump workers compared to matched controls, but ratio of FEV1/FVC was non-significant in petrol pump workers. These results point towards restrictive airway pathology probably affecting the smaller airways of petrol pump workers. The significant decline in AEC of petrol pump workers working more than 5 years duration can be attributed to the affectofbenzene which causes bone marrow suppression.

Hence, the outcome of the present study would encourage further detailed studies with larger samplesize to evaluate the long term effects of petrol derivatives on different systems of the body those are exposed by virtue of their occupation.

Control strategies like periodic health check up including screening of lung function and blood parameters, use of suitable mask, removal of the sensitive workers from the workplace and to create awareness among the petrol pump workers should be adopted to prevent long term morbidity arising out of workplace.

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REFERENCES


