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Study of Pulmonary function test in petrol pump workers of Nagpur city.

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Abstract:

Introduction: Nagpur is an evolving city with a steady rise in automobiles and petrol pumps. It is also known for its high environmental temperature which increases the risk of occupational health hazards damage caused to the body by the environmental pollutants, exhaust emissions and petrol fumes. So this study was undertaken to study the lung functions of petrol pump workers of Nagpur city.

Material and methods: PFT of 60 male petrol pump workers of Nagpur city working for more than six months at petrol stations and aged between 28-36 years was done using Helios 401 computerized Spirometer and compared with 60 age and sex matched controls. The mean values of Forced vital capacity (FVC), Forced Expiratory volume at the end of first second (FEV1), Peak expiratory flow rate (PEFR), Forced expiratory flow rate 25%, FEF50%, FEF75% and Maximum voluntary ventilation (MVV) of cases were compared with controls and tested for statistical significance.

Results: The Mean values of Forced vital capacity (FVC), Forced Expiratory volume at the end of first second (FEV1), Peak expiratory flow rate (PEFR), Forced expiratory flow rate 25%, FEF50%, FEF75% and Maximum voluntary ventilation (MVV) were decreased in cases than controls but statistical significance was only obtained for FVC, FEV1/FVC, PEFR and MVV. Significant negative correlation was obtained for FEV1 and duration of exposure.

Conclusion: The lung function of petrol pump attendants of Nagpur city is decreased. Proper precautions and safety measures must be practised by them to save themselves from this occupational health hazard.

Keywords: Petrol pump workers, PFT, Spirometry, Nagpur

Introduction-

As defined by WHO, Occupational health deals with all aspects of health and safety in the workplace and has a strong focus on the primary prevention of hazards. Industrial growth, urbanisation and poor occupational environment at work places are well known for a number of health related issues. These trends of urbanisation and globalisation have resulted in enormous increase in the number of vehicles on road, which in turn has led to a rise in need of petrol supply. Increased demand has to be fulfilled with parallel increase in supply which has been met with by increasing the number of petrol pumps. Automobiles emit significant amounts of pollutants like nitrogen oxides, Carbon monoxide and hydrocarbons which degrade the air quality. Symptoms like chronic cough, sputum production, wheezing, breathlessness and a well defined and marked systemic pulmonary inflammatory response has been observed on exposure to such pollutants.[1-6] Petrol pump workers are constantly exposed to these environmental pollutants since they spend more than 8 hours per day at petrol

stations. In addition they are also exposed to benzene content of petrol whose toxic effects have been studied on haematological indices, liver and brain.[7-10] Failure to use personal protective equipment adds on to increase the incidence of this occupation related health hazards.

Nagpur is an evolving city, with the number of vehicles increasing day by day leading to a steady rise in the number of petrol pumps in the city. Keeping in mind the degrading air quality of Nagpur due to the exhaust emissions and lack of use of no personal protective equipments by the petrol pump attendants the present study was undertaken. The property of petrol that it is volatile in nature gets exaggerated more at high environmental temperatures. Nagpur city is well known for its high environmental temperature and so the hazards caused due to the benzene content of petrol is all the more increased. So, study of this occupation related health hazard in a city like Nagpur was much needed. This study focuses on the pulmonary functions of the petrol pump attendants of Nagpur city by means of Spirometry. Spirometry is the only valuable tool to assess lung function in the initial asymptomatic stages of respiratory dysfunction, as compared to chest radiographs or arterial blood gas analysis, which fail to do so. Studies have shown that only spirometry helps in the detection of chronic obstructive pulmonary disease (COPD) even before difficulty in breathing develops.[11] It measures the lung function giving results adequate enough to decide whether the person has some lung pathology or not.

Material and Methods –

PFT of 60 male petrol pump workers of Nagpur city working for more than six months at petrol stations and aged between 28-36 years was done using Helios 401 computerized Spirometer. They were grouped as cases and where compared with age and sex matched healthy controls. After getting ethical clearance and written informed consent, detailed history of all the subjects was taken and their thorough clinical examination was also done. The exclusion criteria included smokers, subjects with clinical abnormalities of vertebral column and thoracic cage; subjects with pulmonary tuberculosis, bronchial asthma, subjects who had undergone vigorous exercise, abdominal or chest surgery and subjects suffering from any active respiratory tract infection and or having respiratory symptoms like cough, sputum production, dyspnea, and wheezing.

Spirometry was performed using Helios 401 (Recorders and Medicare systems Private Limited, Chandigarh, India), a computerized electronic type of spirometer, which was attached to a laptop. It is a dry type of spirometer with an internal correction of volumes. Before beginning the tests demonstration was given to each subject separately and it was confirmed whether he had understood the procedure. The subjects were familiarized with the instruments and pulmonary function tests which were to be performed. The data of the subject like name, age, sex, height, weight, the atmospheric temperature was entered into the software program of computerized spirometer. The standing height of the subject was measured by making the subject stand against a wall on which measuring scale was already marked. Head to be held erect and subject was asked to look straight in front without tilt. The highest point on the head was marked on the wall with a plastic ruler and then height was measured up to nearest centimetre. Weight was measured without shoes and was rounded to the nearest kilogram. Age was also rounded to the nearest date of birth.

On the day of Spirometry, subjects were instructed to have breakfast in the morning. All the tests were performed in sitting position. The subjects were asked to place the mouthpiece attached to the spirometer in their mouth. Nose was closed by nose clip. The subject was asked to take deep full inspiration which was followed by as much rapid and forceful expiration as possible through the mouth piece. Since Spirometry is an

effort dependent manoeuvre, proper instructions were given beforehand and it was ensured that the subject understood the procedure and performed according to the current ATS acceptability (individual spirograms free from artifacts, having good starts & satisfactory exhalation) and reproducibility criteria (two largest FVC & FEV1 within 0.2l of each other).[12] Three consecutive readings were taken and best among them was selected for analysis. Subjects who failed to perform with desired acceptability & reproducibility were rescheduled for another day & who still failed to perform were dropped out. Proper hygiene and infection control was maintained. The spirometer was calibrated daily with a 3 litre syringe. The parameters of the pulmonary function tests included in the study were Forced vital capacity (FVC), Forced Expiratory volume at the end of first second (FEV1), Peak expiratory flow rate (PEFR), Forced expiratory flow rate (FEF) 25 - 75 %, FEF 0.2 – 1.2 litres, Forced expiratory flow rate 25%, FEF50%, FEF75% and Maximum voluntary ventilation (MVV).

Statistical methods: Mean and standard deviation were calculated. Student t test was applied to test the significance of mean between cases and controls. Correlation between duration of exposure and lung functions in cases was also studied.

Observations and Results:

Petrol pump workers were grouped as cases and normal healthy volunteers as controls. The two groups were age and height matched as shown in Table.no.1.The Mean values of Forced vital capacity (FVC), Forced Expiratory volume at the end of first second (FEV1), Peak expiratory flow rate (PEFR), Forced expiratory flow rate (FEF) 25 - 75 %, FEF 0.2 – 1.2 litres, Forced expiratory flow rate 25%, FEF50%, FEF75% and Maximum voluntary ventilation (MVV) were decreased in cases than controls as shown in Table no. 2. On statistical analysis it was found that the mean values for FVC, FEV1/FVC, PEFR and MVV were significantly decreased in cases than controls.

Table 1: ***Comparison for age and height in cases and controls***

	Group	N	Mean	Std. Deviation	P value
AGE	Control	60	30.62	2.151	>0.05
	Cases	60	32.82	2.614	
HEIGHT (cms)	Control	60	171.70	4.795	>0.05
	Cases	60	170.04	3.294	

p>0.05- non significant

Cases- petrol pump workers

Table 2: ***Mean, standard deviation and P value for pulmonary function parameters in cases and controls***

	Group	N	Mean	Std. Deviation	Value
FVC	Control	60	3.822	0.4729	0 .002
	Cases	60	3.508	0.6019	
FEV1	Control	60	3.096	0.4499	0.163
	Cases	60	2.957	0.6149	
FEV1/FVC	Control	60	77.8298	10.42257	0.005
	Cases	60	82.1944	4.73933	
PEFR	Control	60	5.0153	1.00486	0.006
	Cases	60	4.4568	1.17131	
FEF 25%	Control	60	4.816	0.9627	0.091
	Cases	60	4.528	0.8574	
FEF 50%	Control	60	3.6790	0.77600	0.433
	Cases	60	3.5758	0.63080	
FEF 75%	Control	60	1.9547	0.38965	0.339
	Cases	60	4.9989	24.54166	
MVV	Control	58	102.47	8.486	<0.001
	Cases	58	81.85	12.663	

p<0.05- significant

Correlation between duration of exposure and all pulmonary function parameters was also studied but a significant negative correlation was observed only with FEV1 as shown in Table no. 3.

Table 3: ***Correlation between various pulmonary function parameters and duration of exposure in years.***

Only in cases		Duration of exposure in years
FVC	Pearson Correlation	-0.211
	P value	0.116
	N	60
FEV1	Pearson Correlation	-0.273*
	P value	0.040
	N	60
FEV1/FVC	Pearson Correlation	-0.157
	P value	0.243
	N	60
PEFR	Pearson Correlation	0.084
	P value	0.533
	N	60
FEF 25%	Pearson Correlation	-0.056
	P value	0.681
	N	60
FEF 50%	Pearson Correlation	-0.227
	Sig. (2-tailed)	0.090
	N	60
FEF 75%	Pearson Correlation	-0.061
	P value	0.650
	N	60
MVV	Pearson Correlation	-0.166
	P value	0.227
	N	60

p<0.05- significant

Discussion:

The purpose of our study was to assess the lung function of petrol pump workers of Nagpur city. In the present study, the values of all the pulmonary function parameters were decreased in cases as compared to controls suggesting that the pulmonary function of the petrol pump workers was affected. However statistical analysis showed significant reduction only for FVC, ratio of FEV1/FVC, PEFR and MVV suggesting mixed pattern of lung disease. Similar findings were reported by previous studies on pulmonary functions in petrol pump workers.[13-16] Some studies have recorded an initial restrictive pattern which progresses to a mixed pattern of lung disease as the duration of exposure increases. In our study out of the 60 petrol pump attendants 54 were

working at petrol stations for more than 4 years i.e they had a long duration of exposure to environmental pollutants, exhaust emissions and petrol fumes. So, since the cases in this study already had a long duration of exposure to pollutants, we might have observed a mixed pattern of lung disease observed in our cases. Studies involving short-term exposure to diesel exhaust in healthy subjects have found a marked systemic and pulmonary inflammatory response, with insignificant change in lung function parameters2. As petrol pump workers in the present study were exposed to petrol and diesel vapours for a longer period of time (8hours/day, >1 year), they were likely to develop chronic respiratory impairment as indicated by the results of the present study.

A significant negative correlation was observed with FEV1 and duration of exposure suggesting that as the duration of exposure increases the pattern of lung disease becomes obstructive type. Similar findings were observed by Priyadarshini et al.[17]The diluted exhausts of petrol contain toxic compound like hydrocarbons and metal like lead which are responsible for structural damage and impaired lung function. Articles state that the particles generated from petrol exhaust are extremely small, with diameters of 0.02nm and since the surface area is large they carry much larger fraction of hydrocarbons and toxic metals on their surface.[18] Because of their ability to remain in the air for longer period, these particles tend to deposit more in the small airways. This affects both the small airway as well as the lung parenchyma leading to a mixed pattern of lung disease. All this occurs as a result of inflammatory response. Since the petrol pump workers are more exposed to these particles from petrol exhaust and these inflammatory changes in their lungs are continuously taking place, they have altered pulmonary function tests. In a developing country like India, there is no standardization in regard to the number of petrol pumps in a particular area, the number of people working at one petrol pump and their duration of work. Since most of these workers are from a low socioeconomic status and have low educational background, proper safety measures should be explained to them with provision of safety equipment with complete knowledge about the hazards of not following these measures.

Conclusion:

The present study clearly shows that the lung functions of the petrol pump attendants were significantly decreased as compared to controls. Hence health awareness and knowledge about safety must be created among the petrol pump attendants to use proper and protective equipments regularly. Rather it must be made compulsory for them. Other preventive measures such as the use of engineering controls, better ventilation systems and substitution of highly toxic agents with less toxic agents must also be practised. Also self-service for petrol/diesel filling may be advocated to prevent the opportunity for exposure in petrol-pump attendants.

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