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Pulmonary Function of Petrol filling Workers from West Bengal, India

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ABSTRACT

Introduction: There are many petrol filling stations in urban and semi urban areas of Hooghly District of West Bengal and a large number of attendants work in these stations. They are constantly exposed to petrol vapour as well as motor vehicle fuel which might lead to respiratory problems in workers.

Objectives: To assess the pulmonary function of Petrol Filling Workers of West Bengal and to evaluate the effect of duration of exposure on those Parameters.

Methods: This is a cross-sectional study design. Pulmonary function test was done among 52 Petrol filling workers and 20 office workers of college as well as students of those institution of Hooghly district and nearby area of Kolkata by simple random sampling method. Pulmonary function parameters were assessed by digital expirograph (Spirovit SP1) and Wright's Peak Flow Meter. A questionnaire was filled up by invigilator regarding years of exposure, respiratory abnormalities, smoking habit and any other diseases. All the study protocol was approved by Human ethical Committee of Raja Peary Mohan College and Serampore college

Results: From the above survey it was observed that respiratory volume and capacities significantly($p<0.05$-0.001) decreased with increase in years of exposure. Odd ratios of different respiratory diseases (OR ranges from 1.12-3.12) indicate risk of developing cough, phlegm, asthma, skin diseases among petrol filling workers.

Conclusion: Safe threshold level of volatile organic compounds VOC exposed in Petrol station is needed to protect the health of workers. Besides periodic health check-up, use of protective gadgets, improvement of technology and control strategies to reduce air emission of VOC-is essential to protect the health of Petrol filling workers of West Bengal.

Key words: Odds Ratio, Petrol filling Workers, Prevalence of respiratory diseases, Pulmonary function,

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Introduction

Petrol, also called gasoline is a complex combination of hydrocarbon. Petrol vapour contains 95% aliphatic and cyclic compounds and less than 2% are aromatic compounds.[1]Benzene content of petrol has typically been in the range of 1-5%. Typical average for 8 hour benzene exposure in distribution and retail operations is less than 1 ppm (parts per million) although exposures can reach 2-3 ppm for shorter periods.[1]

Petrol filling station is a place where workers are exposed to both petroleum vapours and vehicular exhaust. The effects of petrol vapours and the suspended particulate matter may affect of the lung function.[2]

In India, Petrol filling workers are employed for fuel loading rather than self-service which can cause exposure to petrol vapour. Long term exposure to petrol vapour has shown to affect the different physiological systems in the body.[3]

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Air pollutants and chemicals like Benzene, lead, other heavy metals, carbon monoxide and their metabolites can cause adverse health effects by interacting with molecules crucial to the biochemical or physiological process of the human body.[4] All these have been found to lead to deleterious effect on respiratory, endocrine and haemopoietic systems. High ambient air concentration of solvents and pollutants had well defined and marked systemic pulmonary inflammatory response with decreased FVC (Forced Vital Capacity), FEV_1(Forced expiratory volume in 1 sec), Inspiratory and expiratory flow rates.[5]

There are many Petrol filling stations in urban and semi urban area of Hooghly District of West Bengal and a large number of attendants are working in these stations. They are constantly exposed to petrol vapour as well as motor vehicle fuel which might lead to health problem in workers. Therefore, we conducted this study to evaluate the changes in pulmonary function tests of Petrol filling workers in West Bengal. Therefore, the objectives of the present study is -

1. To assess the pulmonary function of petrol filling workers who were exposed to petrol and diesel as well as control group.
2. To evaluate the effect of duration of service/ exposure at the petrol pump on the degree of derangement in pulmonary function.

Methods

This cross-sectional study was conducted in the Petrol filling stations of different areas of West Bengal. Study on Control group was made in their work place and department of physiology of Raja Peary Mohan College and Serampore College. The study group comprised of 52 male Petrol filling workers and 20 control group individuals of same age group male adults working as office workers of college and students of the same area during September – October 2018 by simple random sampling method.

Study Area

The study area has been divided in 4 sub areas like – Kolkata area, Uttarpara area, Bhadrakali area and Bally area. The subjects were selected at random from petrol pump of different areas.

Inclusion Criteria

- Subjects working for more than 1 year in the Petrol Station

Exclusion Criteria

- Workers working for less than 1 year in the petrol filling station.
- Workers with history of tuberculosis, emphysema, and Diabetes mellitus
- Workers with clinical abnormalities of vertebral column & the thorax were excluded.

Respiratory Health Questionnaire

A questionnaire was filled up by the investigator. A modified version of the British Medical Research Council questionnaire[6] was used for respiratory health questions which include information regarding age, smoking habit, feeling of any respiratory distresses during daily activities, job description .

Ethical Consideration

The study protocol was first approved by human Ethical Committee of Raja Peary Mohan College and Serampore College. Besides this, consent from manager of Petrol stations and college authorities as well as participants were taken after explaining the purpose of this study.

The pulmonary function tests (PFT) were performed in their workplace by using automatic spirometer (Spirovit SP 1 model) according to the guideline recommended by American thoracic society.[7] The testing procedures are quite simple and non-invasive and harmless to the participants. The spirometer was calibrated each day prior to use and a new filter was used. The relevant data- age, sex, body weight was recorded. Proper instructions were given to the subject in order to familiarize himself with the equipment. During the tests the subjects were adequately encouraged to perform their optimum level and also a nose clip was applied. The test was repeated 3 times and best results were considered for analysis.

Pulmonary Function Parameters Studied

Forced vital capacity (FVC), Force expiratory volume in 1 sec (FEV1),

Slow vital capacity (SVC), Expiratory reserve volume (ERV), Inspiratory reserve volume (IRV), Tidal volume (TV), FEV1/SVC, FEF 25%-75%, Maximum voluntary ventilation (MVV), FEF 0.2-1.2%, FEF 75%-85% and PEFR

PEFR is measured by Wright's Peak Flow Meter. The

subject was instructed to take a deep breath and place the mouth piece in his/her mouth, between the teeth and with the lips placed tightly around it. Then, they are asked to blow in to the instrument with a short, sharp blow. Reading was recorded. The pointer was reset to zero, by pressing the release button. After a couple of practice blows, 3 attempts in succession were taken and all three attempts were recorded. It is expressed by lit/min.

All the tests were performed between 2 PM to 4 PM to exclude the bias of circadian rhythm. All the gas volumes were corrected to BTPS (Body temperature, ambient pressure and saturated with water vapour) automatically by the instrument.

Physical and Cardiovascular Parameters

Age was recorded from the office record.

Body height was measured by anthropometric rod.

Body weight was taken by using weighing machine with the participant wearing light clothing and without shoes.

Body mass index (BMI) was calculated using formulae Body weight in Kg / (body height in meter)^2

Blood pressure was measured by auscultatory method with the help of a Sphygmomanometer and Stethoscope.

Heart rate was taken by palpatory method.

Results

Social demographic characteristics of the sample population – this study covered a total of 72 respondents including 54 petrol filling workers (PFW) and 20 office workers. This means the PFW comprised of 72%. while office workers make 28% of the total number of respondent. The age distribution, working period, smoking habit are present in Table 1.

Table 2 represents mean ± SD values of age, body height, body weight, BMI, blood pressure and heart rate values of petrol filling workers (PFW) and control group(unexposed) workers. No significant difference has been found in age, heart rate and diastolic blood pressure values between petrol filling workers and control group worker. Body weight, BMI and systolic blood pressure is significantly higher in PFW (P<0.05-0.01) than control group workers.

Table 3 represents mean ± SD values of different pulmonary function parameters of Petrol filling workers and control group. All the pulmonary function parameters are significantly lower than control group (unexposed) workers except TV, FEV_1, $FEF_{25-75\%}$ and $FEF_{75-85\%}$.

Table 4 represents mean ± SD values of physical heart rate, blood pressure and pulmonary function parameters of lower and higher age group PFW. It is found that blood pressure and heart rate values are significantly higher in higher age group PFW but most of the pulmonary function parameters are significantly higher (p<0.05-0.0001) in lower age group PFW workers than higher age group.

Table 5 represents mean ± SD values of physical parameters, heart rate, blood pressure and pulmonary function parameters on the basis of year of exposure. It is found that age, height, SVC, TV, $FEF_{25-75\%}$, $FEF_{75-85\%,}$ values are significantly lower in 11-20 years of exposure in comparison to<10 years of exposure. It is also found that age, blood pressure (systolic), ERV, TV, $FEF_{25-75\%}$, $FEF_{75-85\%,}$MVV,PEFR values are significantly(p<0.05-0.001) lower in >20 years of exposure in comparison to < 10 years and 11-20 years of exposure.

Table 6 represents comparison of mean ± SD values of smoker and non-smoker pulmonary function Parameters with control group. It is found that both smoker and non-smoker PFW have significantly lower values of SVC, FVC, FEV_1, , $FEF_{0.2-1.2}$ $FEF_{25-75\%}$ and $FEF_{75-85\%,}$ MVV and PEFR than control group.

Table 7 shows correlation values between age, height, weight, BMI, blood pressure and heart rate and year of exposure with pulmonary function parameters. It is found that all the pulmonary function parameters are significantly correlated with age, body height, body weight and BMI except SVC.MVV was significantly associated (p<0.05) with age and height. All the pulmonary function values showed significantly (p<0.05-0.001) but negative correlation with age except

SVC, TV and FVC (p>0.05), Highly significant correlation has been found (p<0.05-0.001) between year of exposure and pulmonary function parameters.

Table 8 represents the percentage prevalence of respiratory abnormalities among PFW in comparison to control group. It was observed that 30.76% PFW had restrictive lung impairment, 23.07% and 11.53% had

obstructive and combined lung impairment respectively in comparison to 5% restrictive, 10% obstructive and none had combined lung impairment in control group workers.

It revealed that petrol filling workers who smoke were more prone to have prevalence of chest tightness, asthma and skin problem compared to non-smoking workers.(table 9)

It was observed that higher age group petrol Filling workers were more prone to Chest tightness, asthma and skin problem in comparison to lower age group. (Table 10)

It was found that workers of >20 years of exposure were more to cough, Phlegm and asthma than<10 years and 11-20 years of exposure. (table11)

Figure 1 represents the pie diagram showing percentage prevalence of respiratory diseases and other health problem among petrol filling workers. It was found that 25% (no-13) workers reported eye irritation, 21%(N11) reported skin problem, 13%(N 6.7=7) reported asthma and Phlegm, (17%, N 9) reported cough and 11% (N 6) reported chest tightness.

Table 1: Social demographic characteristics

Characteristics	Petrol filling workers n=52	College/office workers n=20
Age group		
18-34 years	48.07%	65%
>34 years	51.92%	35%
Working period		
0-10 years	57.69%	25%
11-20 years	15.38%	50%
>20 years	26.92%	25%
Smoking habit		
Yes	53.84%	35%
No	46.15%	65%
Daily working hours		
8 hours or less	42.85%	60%
≥8 hours	57.14%	40%
Use of personal protective equipment		
Yes	Nil	nil
No	100%	100%

Table 2: Mean ± SD values of Physical and some Physiological Parameters of Petrol filling workers (PFW) and control group

Parameters	PFW	control	t test
AGE (yrs)	35.91+_11.78	30.7+_12.59	0.12
HEIGHT(cm)	164.6+_6.18	167.9+_4.5	0.019 **
WEIGHT (kg)	66.6+_12.4	61.37+_8.78	0.05*
BP(systolic) (mm Hg)	139.3+_18.8	129.4+_13.1	0.01***
BP(Diastolic) (mmHg)	79.7+_11.5	77.4+_9.6	0.39
HEART RATE (beats/min)	83.1+_11.96	79.45+_6.53	0.10
BMI (Kg/m^2)	24.52+_4.3	21.84 ± 3.82	0.01***

P<0.05 - *, p<0.02**, p<0.01-*** BMI=Body Mass Index

Table 3: Mean ±SD values of different pulmonary functional parameters of Petrol filling workers (PFW) and control group.

Respiratory Parameters	PFW (n=52)	control (n=20)	t test
SVC	2.66+_0.64	4.2+_0.93	0.001****
ERV	0.554+_0.39	1.2+_0.69	0.001****
IRV	1.28+_0.45	2.1+_0.79	0.0001****
TV	1.05+_0.53	0.88+_0.34	0.11
FVC	2.70+_0.78	4.2+_0.87	0.001****
FEV1	2.74+_0.88	3.4+_.66	0.001****
FEV1/SVC	89.5+_22.29	85.05+_10.04	0.25
FEF.2-1.2	5.15+_2.04	7.2+_2.29	0.001****
FEF25-75%	4.07+-1.08	4.6+_2	0.30
FEF75-85%	2.22+_1.09	2.3+_1.4	0.83
MVV	95.3+_35.9	153.3+_37.28	0.001****
PEFR	361+_97.21	407.7+_56.64	0.01***

p<0.05 - *, p<0.02-**,p<0.01 - ***, p<0.001 - ****

Table 4: Mean ± SD values of physical parameters, Blood pressure, Heart rate & pulmonary function values of higher and lower age group of petrol filling workers.

	AGE GROUP		T test
	14-34 YEAR (n=25)	34-above (n=27)	
HEIGHT	164.7±4.1	164.7±7.6	0.99
WEIGHT	65.4±11.4	68.0±13.6	0.41
BP(SYSTOLIC)	129.8±12.7	149.1±19.2	0.0001****
BP(DIASTOLIC)	77±8.8	82.6±13.25	0.07
HEART RATE	78.6±10.9	87.2±11.3	0.008***
BMI	24±3.6	25.1±4.9	0.35
SVC	2.79+_0.70	2.51+_0.58	0.129
ERV	0.49+_0.41	0.59+_0.36	0.36
IRV	1.42+_0.43	1.16+_0.43	0.001***
TV	1+_0.5	1.10+_0.51	0.06
FVC	2.7+_0.74	2.5+_0.8	0.01**
FEV1	2.6+_0.81	2.2+_0.91	0.05*
FEV1/SVC	90.4+_15.6	87.9+_27.1	0.60
FEF.2-1.2	5.7+_1.8	4.4+_2	0.05*
FEF25-75%	4.8+_1.8	3.3+_1.3	0.001***
FEF75-85%	2.8+_1.08	1.6+_0.7	0.001****
MVV	105.8+_38.3	84.9+_30.35	0.03*
PEFR	383.7±95.7	344.2±96.5	0.01**

P<0.05 - *, p<0.01-**, p<0.001 - ***, p<0.0001 - **** BMI=Body Mass Index

Table 5: Comparison of Mean ± SD values of physical parameters, heart rate, blood pressure and pulmonary function parameters of petrol filling workers based on year of exposure.

	0-10 years(n=30)	11-20 years(n=8)	>20 years(n=14)	T test (0-10 with 10-20)	T test (0-10 with >20)
AGE	29.9±9.88	37.5±3.83	49±6.1	0.001***	0.001****
HEIGHT	164.6±4.5	168.3±2.7	163.1±9.4	0.02*	0.61
WEIGHT	66.43±12.89	71.58±10.4	64.6±+_12.4	0.318	0.68
BP(systolic)	133.2±14.9	144.3±17.3	151.3±21.9	0.188	0.01**

Table 5 cont ...

BP(diastolic)	78.2±10.2	78.3±20.79	83.7±8.14	0.994	0.07
HEART RATE	78.2±10.35	89.1±8.13	84.8±9.9	0.076	0.32
BMI	24.43±4.26	25.32±4	24.3±4.8	0.638	0.95
SVC	2.6 ± 0.55	3±1.14	2.4±0.5	0.05*	0.25
ERV	0.5±_0.4	0.40±0.31	.71±.36	0.465	0.01**
IRV	1.3±0.44	1.35±0.42	1.1±.49	0.89	0.36
TV	1±0.5	1.4±0.52	0.92±0.49	0.01**	0.05*
FVC	2.6±0.71	3.09±1.07	2.73±0.72	0.368	0.06
FEV1	2.5± 0.77	2.8±1	2.1±1	0.49	0.200
FEV1/SVC	88.8±17.8	97.4±28	87.4±29.1	0.48	0.873
FEF.2-1.2	5.4±1.7	4.9±2.8	4.6±2.3	0.71	0.32
FEF25-75%	4.4±1.66	3.6±2.4	3.4±1.5	0.02*	0.05*
FEF75-85%	2.5±1.1	2±.68	1.5±0.89	0.016**	0.001***
MVV	95.56±36	114.7±53.9	85.7±22.9	0.43	0.001***
PEFR	371.6±96.8	365±110	334.6±94.7	0.89	0.05*

P<0.05 - *, p<0.01-**,p<0.001 - ***, p<0.0001 - **** BMI=Body Mass Index

Table 6: Comparison of mean ± SD values of pulmonary function parameters of smoker and non smoker petrol filling workers with control group

Respiratory parameter	Petrol filling workers		Control		t test	
	smoker (n=28)	non-smoker (n=24)	smoker (n=7)	non smoker (n=13)	smoker t test	non-smoker t test
SVC	2.7+_0.68	2.55+_0.68	3.8+_1.2	4.57+_0.68	0.05*	0.001****
ERV	0.52+_0.41	0.56+_0.42	0.68+_0.34	1.5+_0.49	0.31	0.001****
IRV	1.42+_0.42	1.18+_0.49	2.26+_1.03	2.06+_0.67	0.07	0.0005****
TV	0.99+_0.50	1.10+_0.56	0.91+_0.36	0.86+_0.34	0.66	0.012**
FVC	2.64+_0.82	2.68+_0.74	3.9+_1.04	4.42+_0.75	0.001****	0.001****
FEV1	2.48+_0.91	2.3+_0.43	3.19+_0.97	3.6+_0.38	0.01***	0.001****
FEV1/SVC	88.39+_22.49	90.9+_27.1	84.6+_11.39	85.3+_9.7	0.05*	0.47
FEF.2-1.2	5.20+_2.05	4.9+_2.1	6.7+_3.09	7.5+_1.8	0.024	0.0005****
FEF25-75%	4.12+_1.7	3.9+_1.7	3.5+_2.9	5.9+_1.75	0.05*	0.08
FEF75-85%	2.25+_1	2.5+_1.15	1.8+_1.4	2.5+_1.39	0.05*	0.03*
MVV	99.67+_32.62	85.04+_37.3	153.3+_49.3	153.3+_31.3	0.028**	0.001****
PEFR	374.23±100.2	340.86±103.8	411.4±49.13	405.6±62.1	0.01***	0.02**

P<0.05 - *, p<0.01-**, p<0.001 - ***, p<0.0001 - ****

Table 7: Correlation between physical parameters, cardio vascular and respiratory parameters of petrol filling workers of West Bengal

	Age	Height	Weight	BMI	BP(systolic)	BP(diastolic)	HR	Year of exposure
SVC	-1.78	.28	0.79	0.96	-1.39	-0.36	0.43	3.26***
ERV	3.06***	2.35*	-0.36	-1.78	-2.43**	0.02	-2.17*	4.55****
IRV	-2.25*	1.78	2.02*	-2.02*	-1.54	1.39	0.14	2.63**
TV	0.21	-0.21	2.25*	3.06***	0.94	0.60	2.02*	3.78****
FVC	-1.71	1.85	0.5	-2.10*	-0.80	0.7	0.07	3.98****
FEV1	-3.52****	2.50**	0.69	-2.43**	-3.21***	-0.57	0.073	2.30*
FEV1/SVC	-2.17*	2.25*	0.04	-1.99	-2.61**	-0.36	0.02	4.55****
FEF.2-1.2	-2.35*	1.54	4.73****	-0.3	-1.23	-2.35*	-1.74	2.7***

Table 7 cont ...

FEF25-75%	-3.41***	3.13***	3.13***	-1.47	-1.47	-0.28	2.02*	2.5**
FEF75-85%	-4.06****	3.13***	-1.54	-2.27*	-2.43**	-0.57	-2.43**	3.50***
MVV	-2.17*	0.07	2.02*	1.54	-0.43	-1.78	-2.94***	2.3*
PEFR	-2.27*	2.10*	2.61**	1.93	2.50***	2.43**	0.28	2.89***

p<0.05 - *, p<0.02-**, p<0.01 - ***, p<0.001 - **** BMI=Body Mass Index

Table 8: Percentage **prevalence of respiratory abnormalities among petrol filling workers in comparison to control group**

	Petrol filling workers(n=52)						All		Control(n=20)	
	Higher age group			Lower age group			No.	%	No.	%
	All	S	NS	All	S	NS				
Normal	10	5	5	8	5	3	18	34.61	17	85
Obstructive	5	4	1	11	5	6	16	30.76	1	5
Restrictive	8	5	3	4	1	3	12	23.07	2	10
Combined	2	1	1	4	2	2	6	11.53	0	0

Table 9: Prevalence of different diseases physiological symptoms among smoker and non-smoker petrol filling workers with odds ratio and 95% confidence interval.

GROUP		Cough				Phlegm				Chest Tightness				Asthma				Skin Problem			
		No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI
S	28	4	14.2	0.63	0.15 - 2.69	4	14.2	0.17	0.23 - 5.8	4	14.2	1.83	0.3-5.11	4	14.2	1.17	0.23-5.8	7	25	1.26	0.34-4.6
NS	24	5	20.8	-	-	3	12.5	-	-	2	8.3	-	-	3	12.5	-	-	5	20.8	-	-
T	52	9				7				6				7				12			

T: Total

Table 10: Prevalence of different physiological symptoms among higher and lower age group petrol filling workers with odds ratio and 95% confidence interval.

GROUP	No.	Cough				Phlegm				Chest Tightness				Asthma				Skin Problem			
		No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI
LA	27	6	22.2	0.47	0.1 – 2.1	5	18.5	0.38	0.06-2.18	2	7.4	2.38	0.39-14.3	2	7.4	3.12	0.54-17.8	6	22.2	1.109	0.3-4.0
HA	25	3	12	-	-	2	8	-	-	4	16	-	-	5	20	-	-	6	24	-	-
T	52	9				7				6				7				12			

LA=Lower age group HA= Higher age group

Table 11: Prevalence of different Physiological Symptoms among petrol filling workers with different level of year of exposure with odds ratio and 95% confidence interval.

years	No.	Cough				Phlegm				Chest Tightness				Asthma				Skin Problem			
		No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI	No.	%	OR	95% CI
>20	14	4	28.5	1.76	0.28 – 11.29	2	14.2	2.4	0.47-18.3	0	0	-	-	3	21.8	1.26	0.34-4.67	4	28.5	0.63	0.14-2.7
11-20	8	3	37.5	1.19	0.26-5.14	3	37.5	1.19	0.26-5.12	2	25	0.46	0.06-3.13	2	25	2.14	0.35-18.3	2	25	0.75	0.12-4.69
10	30	2	6.6	-	-	2	6.6	-	-	4	13.3	-	-	2	6.6	-	-	6	20	-	-
TOTAL	52	9				7				6				7				12			

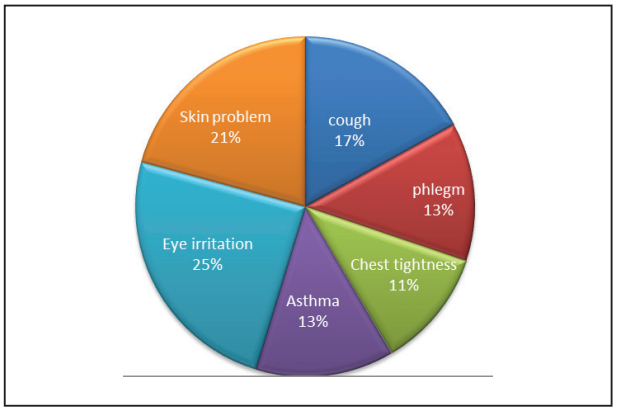

Figure 1: percentage of respiratory abnormalities among petrol filling workers.

Discussion

The major finding of this study is that there is significant decrease in FVC, FEV_1, PEFR values when compare to their control group but the ratio of FEV_1, /FVC ($FEV_{1\%}$) did not differ between the two groups. This finding indicates the restrictive pattern of pulmonary function in the petrol filling workers[8] which corroborates with our study (PFW- 30.76% restrictive, control group 5%). Paggiaro et al [9] showed that occupational exposure to organic solvents might cause chronic air way impairment with nonspecific bronchial hyper responsiveness in shoe factory workers. Kesavachandram et al [5] found that high prevalence of respiratory symptoms was primarily a consequence of exposure to the petrol vapours found in the work place in the petrol filling stations.

In the present study pulmonary function parameters – SVC, TV, $FEF_{25-75\%}$, $FEF_{75-85\%}$, decreased significantly after 11-10 years of exposure and ERV, TV, $FEF_{25-75\%}$, $FEF_{75-85\%}$, MVV, PEFR decreased significantly after 20 years of exposure but reduction of other parameters, were not significant with the increase in year of exposure to petrol vapours. Singhal et al [10] has shown that petrol filling workers with less than 5 years had little chance to develop respiratory health problem in comparison to our study where significant lung impairment was found after 20 years of exposure. Similarly, Bhide et al [11] reported that lung volumes were decreased in petrol filling workers working for more than 5 years in comparison to those working less than 5 years. Similar findings were reported by Sharma et al [12]Aprajita et al [13]Uzma et al[3] and Dube et al.[14]

Exposure to diesel exhaust and other pollutants leads to respiratory symptoms and derangement in lung function. These changes are mainly due to increase in airway resistance and inflammatory changes in lungs due to exposure to diesel exhaust and petrol vapour fumes. Li et al [15] reported neutrophil influx into lungs and increase in broncho alveolar lavage fluid concentration of tumor necrosis factor in rats following intratracheal instillation of ultra fine carbon particles.

Nightingale et al[16] stated that Benzene content in petrol is in the range of 1-5% which has an exaggerating cause for lung function derangements in petrol filling workers.

Odds ratio of different respiratory diseases and other health problems of petrol filling workers indicated increased risk of cough, phlegm, asthma and eye irritation with the increase in years of exposure indicating that exposure to petrol and diesel exhaust for longer duration, leads to derangement of pulmonary functions. As most of petrol pumps are on heavy traffic roads, workers are also exposed to heavy air pollution. The petrol and diesel exhaust particles are very small in size about 0.2nm. Owing to their small size, these particles have large surface area so they can carry large amount of toxic compounds such as hydrocarbons and metals on their surface. These particles can remain air borne for longer period and can deposited deeper in smaller airways of lung [17]. Petrol filling workers of West Bengal do not wear personal perfective equipment so risk of development of pulmonary diseases is very high.

Comparing smoker and non smoker petrol filling workers with control group regarding pulmonary function parameters, it was found that all the pulmonary function parameters were lower in both smoker and non smoker workers than control group indicating exposure to petrol vapour is the prominent risk factor in declining the pulmonary function parameters.

Age group wise comparison of pulmonary function parameters between higher and lower age group petrol filling workers, showed that higher age group petrol filling workers had reduced pulmonary function parameters than lower age group workers indicating the effect of age in addition to petrol vapour exposure in reduction of pulmonary function parameters.

Blood pressure, resting heart rate and BMI values of petrol filling workers when compared to the control group it was found that petrol filling workers had significantly higher systolic blood pressure, heart rate, and BMI, indicating the metabolic effects of petrol vapour exposure which probably affects through T_3, T_4 and TSH secretion that can influence the metabolic

process of the body.[3] Gustafson et al[18] studied and found that significantly decrease in TSH and T_3 level but T_4 levels were increasing within the normal ranges with the increase in year of exposure to petrol vapour. This decrease in TSH level could be either due to the toxic effect of solvent like benzene present in petrol vapour and polluted air. The low level of TSH is probably associated with central pituitary dysfunction due to solvent and polluted air exposure. Besides some of the solvents and pollutants like lead present in petrol vapour can accumulated in many organs including thyroid gland and exert toxic effect by causing damage directly on the target organ or depressing their functioning.[3]

Thus, this study demonstrates reduction of certain respiratory and physiological parameters in the occupationally exposed petrol workers. The data suggests that exposure to benzene and air pollutants may account for substantial part of respiratory and cardiovascular dysfunctions.

As benzene is the main component of petrol vapour, measurement of air quality and VOC will provide guideline for safe standard level benzene in workplace along with control strategies for air pollution.

Recommendations

Present study focuses on respiratory impairment and odds ratio indicates the increased risk of respiratory disorders of Petrol filling workers exposed to VOC. In order to prevent this risk pre employment and periodic check-up of respiratory parameters can be suggested. Besides, use of protective masks and application of engineering control system might regulate the VOC emission and working environmental can be protected. Again, participation of regular physical activity of Petrol filling workers can be recommended for increase in strength of the skeletal muscle including respiratory muscles.

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