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Effect of petrol fumes on an anthropometry and ventilatory function among petrol pump workers of Puducherry, India

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ABSTRACT

The study of Occupational health in petrochemical industry examines to promote health and safety to the workers in India. The Hazards and risk involved in the petrochemical industry is high compared with other industries and least importance is given to worker's health. Most of accident does not come to the legal formalities. The People are not aware of health and safety is due to the workers are uneducated and management not given importance due to promote Industrial health and Occupational safety in petrochemical industry becomes a barrier in implementing Industrial health and Occupational safety. Present study is an analytical cross sectional, aims to study to determine the effect of petrol fumes on anthropometry and ventilatory function among petrol pump workers in district Pondicherry, Puducherry, India. 84 petrol pump workers with age, sex, weight and height matched controls were recruited from among 102 pump workers in Pondicherry. Using the modified British Medical Research Council Questionnaire, the ventilatory function parameters of the subjects and controls were measured with an microplus spirometer. The mean values of ventilatory function parameters of petrol pump workers were lower than that of controls but only that for PEFR was statistically significant. The mean ventilatory parameters by the work hour per week and by the number of vehicles filled per day were statistically significant for $FEV_{1.0}$/FVC, PEFR and FEV_{10}, $FEV_{1.0}$/FVC, PEFR. Abnormal ventilatory function was seen in a good percent of petrol pump workers (29.76%) which consisted of obstructive defects (16.67%) and restrictive defects (13.09%) compared to (13.09%) and (8.33%) in the control groups respectively. The difference was not statistically significant. The mean ventilatory function parameters in workers who smoke was lower than in control groups who smoke. The difference was statistically significant for $FEV_{1.0}$/FVC. The mean ventilatory function parameters in non-smoking workers were significantly lower than in non-smoking controls. There was no statistically significant difference in the mean ventilatory function parameters of petrol pump workers who smoke and those who do not smoke. The study showed that exposure to petrol fumes among petrol pump workers (who had worked as such for more than one year) had significant effect on their ventilatory function and not much on anthropometry. The study also showed that abnormal ventilatory pattern was prevalent in petrol pump workers, predominant ventilatory dysfunction was obstructive.

***Keywords**: $FEV_{1.0,}$ FVC, PEFR, Ventilatory functions, Spirometer, Petrol pump workers.*

INTRODUCTION

The past ten years had seen a marked increase in concern about exposure to potentially harmful substances in both workplaces and elsewhere in the environment. Bernadine Ramazzin, the father of occupational medicine urged doctors to seek from patients, information about the jobs they do and to visit their workplaces (Bourke, 2003). The study of Occupational health in petrochemical industry examines to promote health and safety to the workers in India. The Hazards and risk involved in the petrochemical industry is high compared with other industries and least importance is given to worker's health. Most of accident does not come to the legal formalities. The People are not aware of health and safety is due to the workers are uneducated and management not given importance due to promote Industrial health and Occupational safety in petrochemical industry becomes a barrier in implementing Industrial health and Occupational safety (Jaiswal,2015).

Review of literature shows that there are various studies have been done on the health status of workers in various industries. Most of these studies concentrated on acute effects of exposure to cement (Alakija et.al, 1990), coal dust (Ogakwu, 1973), gas welders (Erhabor et.al, 1992), and asbestos (Zejda, 1996), powdered tobacco (Maduka et.al, 2009), wood dust (Okwari et.al, 2005), cotton dust (Oleru, 1980; Jaiswal, 2013) and textile fibre (Jaiswal, 2015 and 2018). Petrol also known as Premium motor spirit (PMS) or gasoline is a complex combination of hydrocarbons and non-hydrocarbons. About 95% of the components in petrol vapour or fumes are alicyclic compounds and less than 2% aromatics (Gupta and Dogra, 2002). Non hydrocarbon components include Sulphur, vanadium and nickel (Alakija et.al, 1990). In India, Petrol station workers are the norms rather than self-dispensers as done in western countries, increasing the propensity for exposure (Rowat, 1998). Some petrol station workers do not wear personal protective equipment and personal hygiene is variable at workplace.

Atmospheric concentration of gasoline vapour (approximately 2000 ppm) is not safe when inhaled even for a brief period of time. During fuelling of vehicles, the atmospheric concentration is between 20 to 200 ppm (Lewne et.al, 2006; Pranjic et.al, 2002). This amount is higher when there are long queues of cars to be fuelled, which is a usual occurrence during fuel scarcity in India. Alternatives to petrol like CNG has been introduced into Indian automobile industry but not in a full-fledged matter and limited to few district or states of India, therefore millions of automobiles on the roads run on petrol or diesel fuel (Guldeberg, 1992).

MATERIAL AND METHOD

This study was carried out among filling station workers in in district Pondicherry, Puducherry, India. Exposure to petrol fumes was evaluated in terms of work place exposure of more than a year, the number of vehicles filled per day and work hour per week. Pondicherry is located in southern part of India near the eastern coastal region of Tamil Nadu. Pondicherry is a Union territory cosmopolitan tourist place of India. Present study was a population based analytical cross-sectional study carried out to compare subjects (petrol station workers) with prolonged exposure to premium motor spirit or gasoline to those of controls group. The controls were of similar socio- economic background with the subjects. The twelve filling stations of Pondicherry city and border area of Pondicherry and Tamil Nadu were included in this study. These filling stations employ 102 petrol workers. All filling stations and their workers were included in the

study. The prevalence of lung function abnormalities in petrol station workers in South India is still largely unknown; hence, using a community prevalence of 50%, the sample size is thus calculated using the formula in healthy survey (Medical Research Council Committee, 1960; American Conference of Government and Industrial Hygienist manual on environmental health. 1993).

nf= n/1+[n]/N

Where, nf= the deserved sample size when population is less than 10,000.
n= the desired sample size when population is more than 10,000.
N= the total population which in this case is 102.
$n=\{z/d\}^2$ p q
z= the standard score corresponding to a given confident level.
p= estimated disease prevalence.
q=1-p
$n= [1.96/0.05]^2$ 0.5[1- 0.5]
n= [3.8416/0.0025]0.25
n= 384.

The sample size nf= n/1+ [n]/N
=384/1 + [384/102]
=384/1+3.764
=384/4.764 =80.605 = ~ 81

The estimated sample size was 81 subjects. However, 84 completed the study. 13 subjects did not meet the criteria for inclusion in the study. 4 subjects did not give consent and 1 dropped out of the study. 84 individuals were used as controls, who is not working in petrol pump but working in Pondicherry University hostels.

Only consenting subjects who satisfy the inclusion criteria were selected like Petrol station workers above the age of 18 years, Duration of employment of more than 1year. Petrol station workers who dispenses Premium motor spirit (PMS) for more than 8 hours a day or for at least 40 hours per week, in line with criteria set by American Conference of Governmental and industrial hygienist and National Institute of occupational safety and health(NIDSH) of America, on occupational exposure limit to gasoline or Premium Motor Spirit (American Conference of Government and Industrial Hygienist manual on environmental health. 1993). The controls were recruited to match for age, sex, weight and height. Some of the respondent were excluded from the study based on following criteria like Petrol pumps workers who do not give consent, Co-morbid clinical condition that may affect or compromise the cardiopulmonary system of subjects or participants, for example respiratory problem, hypertension, asthma, diabetes mellitus, tuberculosis, pneumonia., past history of occupational exposure to substances that have been documented to affect ventilatory function e.g. dust, textile fiber, cement, factory worker, quarry worker, mine workers, car spray painters, pottery makers etc.

Relevant data were collected using a modified British Medical Research Council questionnaire (Douglas et.al, 2005). Respondents were classified using WHO criteria (1998) as: (a) Smokers (b) Non-smokers (c) Ex-smokers. Current smokers are those who take at least a stick of cigarette daily or occasionally or its equivalent in other tobacco based products, while ex- smokers are

those who stopped smoking before the study. Non-smokers are those who had never smoked or had not smoked more than one stick of cigarette in their lifetime. Number of Pack years is calculated as the product of number of years and average number of cigarette smoked daily divided by 20 (number of sticks of cigarette per pack) (Agnew, 2010).

The Anthropometry and Spirometry data was then collected from all subjects after taking their both oral and written consent, using an anthropometry rod for height, weighing balance for weight, Microplus spirometer for Ventilatory Function. A total of up to three tests were allowed before a subject was declared unable to perform the procedure. The best or highest three reproducible results after maximal expiration within 5% of predicted value for age, height and sex were recorded for each subject (Erhabor, 2010). The flow volume curve was recorded and parameters which were measured include $FEV_{1.0}$ (Forced expiratory volume in 1st second), FVC (Forced vital capacity), $FEV_{1.0}$/FVC (Forced expiratory ratio) and PEFR (Peak expiratory flow rate). ATS/ERS guidelines were used to interpret the results. The data obtained was analyzed using SPSS 20.0. Means and standard deviation were used to summarize numerical quantitative variables. The means of all the numerical variables were compared using p value and student t-test. Percentages and proportions were used to describe categorical variables and test of statistical significance and relationships between dependent variables were done using Chi-square test and F test at 5% level of significant.

RESULTS

Table 1: Distribution of Petrol Pump Workers and Controls Group According to their Mean Age, Weight, Height and BMI.

Variables	**Petrol Pump Workers** Mean±SD	**Controls** Mean±SD	**t-value**	**p-Value**
Age (years)	25.32±4.52	25.74±4.42	0.585	0.541
Weight (kg)	63.68±9.40	65.21±9.46	0.770	0.441
Height (m)	1.54±0.08	1.53±0.08	1.670	0.093
BMI (kg/m^2)	26.85±3.80	27.86±3.40	0.121	0.801

Table 1 shows the mean and standard deviation of age, weight, height and Body Mass Index (BMI) of petrol pump workers and controls groups of Pondicherry. The mean age of petrol pump workers was 25.32±4.52 years while that of control subjects was 25.74±4.42 years. The difference was not statistically significant. The mean and standard deviation values of body weights of petrol pump workers and controls were 63.68±9.40 and 65.21± 9.46 kg respectively, the difference was not statistically significant (t = 0.770, P = 0.441), whereas the mean heights were 1.53±0.08 and 1.53±.08 m respectively, the difference in height was also not statistically significant. The mean BMI of petrol pump workers and control were 26.85±.80 and 27.86±.40 respectively. Statistically non-significant difference was also observed between workers and control groups in case of BMI.

Figure 1: Distribution of petrol pump workers (respondents') exposure to petrol fumes per week at work.

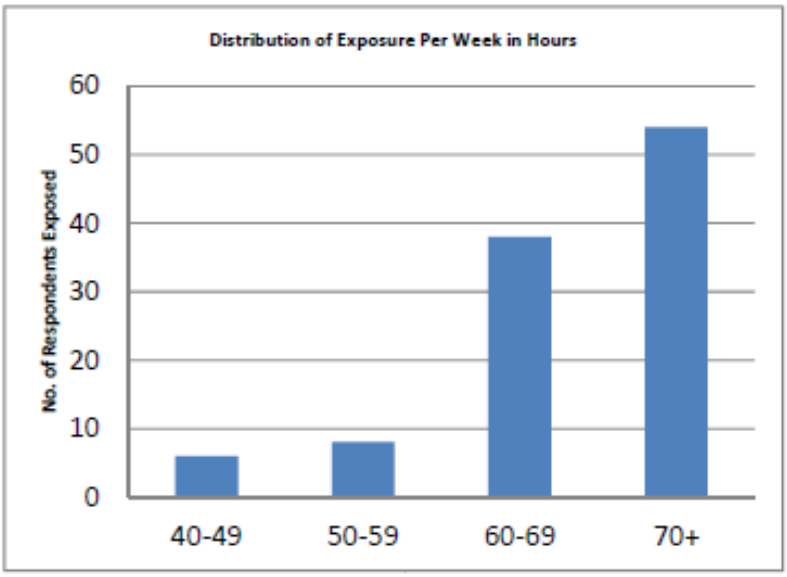

Figure 1 show that 50.9% of petrol pump workers worked for >70 hours per week whereas nearly 40% of petrol pump workers worked for 60-69 hours per week. The mean duration of work hour per week was 65.80 + 8.78 hours per week.

Figure 2: Distribution of exposure by the number of vehicles filled per day by petrol pump workers

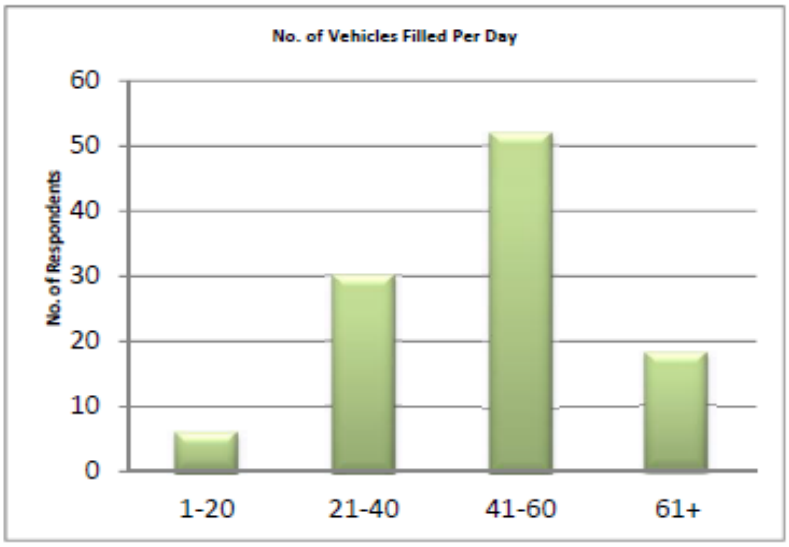

Figure 2 shows that nearly 50% of petrol pump workers filled, between 41- 60 vehicles per day, followed by (28.3%) and nearly 5% of petrol pump workers who filled between 21 – 40 vehicles per day. About 17% of petrol pump workers filled more than 61 and 1-20 vehicles per day respectively. The mean number of vehicles filled per day by petrol pump workers was 58.42+ 12.66.

Table 2: Distribution of the duration of Employment (in Years), Smoking Status, Mean and Standard Deviation Values of Ventilatory Function Parameters of Petrol Pump Workers and Controls

Variables	**Duration of Employment (Years)**		**No.**		**%**	
Duration of Employment (Years)	1-5		43		51.19	
	6-10		32		30.09	
	11-15		5		5.95	
	16-20		3		3.57	
	21+		1		1.19	
Smoking History	**Petrol Pump Workers**		**Controls**		χ^2	**p-Value**
	No.	**%**	**No.**	**%**		
Smokers	11	13.09	15	17.86	1.324	0.517
Ex-Smokers	17	20.23	19	22.62		
Non-Smokers	56	66.66	50	59.52		
Mean Pack Years	**Mean±SD**		**Mean±SD**		**t-value**	**p-Value**
Smokers	4.5±0.6		6.2±1.3		-0.129	0.140
Ex-Smokers	1.2±0.5		6.8±0.8		-0,216	0.002
Variables/Parameters	**Mean±SD**		**Mean±SD**		**t-value**	**p-Value**
$FEV_{1.0}$(L)	3.47±0.64		3.61±0.63		1.62	0.106
FVC (L)	4.16±0.58		4.30±0.60		1.67	0.097
$FEV_{1.0}$/FVC	0.83±0.10		0.84±0.10		0.77	0.443
PEFR (L/min)	374.62±67.13		393.68±59.31		2.19	0.030*

*p value > 0.05

Table 2 shows that maximum 51.19% petrol pump workers have worked for less than 5 years followed by 30.09% and 5.95% have worked for 6-10 and 11-15 years respectively while only a small percent (10.71%) have worked for >10 years. As per the data on smoking history concern, 13.9% petrol pump workers were current smokers, compared to 17.86% among control subjects.

However, among workers 20.23% and 66.66% were ex-smokers and non-smokers respectively and in the case of control groups, 22.62% and 59.52% were ex-smokers and non-smokers respectively. Similarly, the mean pack years of smoking were 4.5±0.6 and 6.2±1.3 for petrol pump workers and controls respectively. However, the mean values of $FEV_{1.0}$, FCV, $FEV_{1.0}$/FVC and PEER were lower in petrol pump workers compared to controls.

Statistically non-significant differences were observed between petrol pump workers and control groups in case of smoking history, mean pack years of smoking and mean values of ventilatory function Parameters except PEFR i.e. Statistically significant differences were observed between petrol pump workers and control groups in case of mean values of PEER ventilatory function Parameters (p value > 0.05)

Table 3: Distribution of Mean Values of Ventilatory Function Parameters in Petrol Pump Workers by work hour per week and Numbers of Vehicles filled per day

Ventilatory Function Parameters	<70 hours Mean±SD	>70 hours Mean±SD	t-value	p-Value
$FEV_{1.0}$(L)	3.45±0.63	3.27±0.68	1.47	0.146
FVC (L)	4.07±0.59	4.04±0.58	0.31	0.756
$FEV_{1.0}$/FVC	0.87±0.09	0.80±0.12	2.58	0.011*
PEFR (L/min)	378.0±62.89	351.3±58.42	2.17	0.033*
Numbers of Vehicles filled per day	**$FEV_{1.0}$(L) Mean±SD**	**FVC (L) Mean±SD**	**$FEV_{1.0}$/FVC Mean±SD**	**PEFR (L/min) Mean±SD**
1 – 20	3.89±.0.58	4.41±.0.60	0.88±0.04	411.73±33.24
21 – 40	3.65±0.62	4.22±0.59	0.85±0.06	398.51±46.42
41 – 60	3.37±0.59	4.07±0.53	0.82±0.09	367.72±67.23
61+	3.23±0.67	4.16±0.66	0.77±0.13	336.40±78.20
ANOVA	0.033*	0.446	0.024*	0.006*
F-test	3.023	0.894	3.329	4.375

*p value < 0.05

Table 3 shows that the mean and standard deviation values of ventilatory function parameters ($FEV_{1.0}$, FCV, $FEV_{1.0}$/FVC and PEFR) were lower in petrol pump workers who worked for more than 70 hours per week compared to those who worked for less than 70 hours per week. However, in case of number of vehicle filled by petrol pump workers per day, the mean values of FEV_1, FVC, $FEV_{1.0}$/FVC and PEFR decrease with increase in the numbers of vehicles filled per day.

Statistically significant differences were observed between petrol pump workers working for less than 70 hours per week and petrol pump workers working for more than 70 hours per week in case of mean values of $FEV_{1.0}$/FVC and PEFR. PEER ventilatory function Parameters (p value > 0.05). Similarly, the decrease in ventilatory functions with increase in number of vehicles filled by petrol pump workers per day was statistically significant for $FEV_{1.0}$, $FEV_{1.0}$/FVC and PEFR ($p< 0.05$).

Table 4: Pattern of Ventilatory function by Duration of Employment in Petrol Pump Attendants and The distribution of Pattern of Ventilatory Function in Petrol Pump Attendants and Controls

Duration of Employment	Normal (59)		Obstructive (14)		Restrictive (11)	
	No.	%	No.	%	No.	%
1-5	37	62.71	3	21.43	3	22.27
6-10	20	33.89	4	28.57	6	44.54
11-15	2	3.39	3	21.43	1	9.09
16-20	0	0.0	2	14.28	1	9.09
21+	0	0.0	2	14.28	0	0.0
Lung Function	**Petrol Pump Workers**		**Controls**		χ^2	**p-Value**
	No.	**%**	**No.**	**%**		
Normal	59	70.24	66	78.57	2.484	0.286
Obstructive	14	16.67	11	13.09		
Restrictive	11	13.09	7	8.33		

Table 4 shows that there was no increase in the number of abnormal ventilatory pattern (obstructive and restrictive) with increase in duration of employment. The highest number of abnormal ventilatory pattern was seen in petrol pump workers who worked for 6-10 years. However, in case of lung function, normal ventilatory pattern was reported in 70.24% of petrol

pump workers and 78.57% in case of control subject. Obstructive pattern was reported in 16.67% of petrol pump workers and 13.09% of control subjects. Also, 11.09% of petrol pump workers had restrictive pattern compared to 8.33% of control subjects. statistically non-significant difference was observed between workers and control subjects.

Table 5: The Mean Values of Ventilatory Function Parameters in Petrol Pump Workers and Controls by Smoking Status

Variables		**Petrol Pump Workers**	**Controls**	**t-value**	**P-Value**
Smoking Status	**Ventilatory Function Parameters**	**Mean±SD**	**Mean±SD**		
Smokers	$FEV_{1.0}$	3.43±0.66	3.53±0.66	1.696	0.098
	FVC	4.25±0.54	4.41±0.56	0.834	0.411
	$FEV_{1.0}$ /FVC	0.85±0.67	0.74±0.14	3.075	0.004*
	PEFR	376.70±64.66	354.52±71.88	0.906	0.370
Ex-Smokers	$FEV_{1.0}$	3.51±0.72	3.60±0.64	0.432	0.665
	FVC	4.32±0.58	4.25±0.68	0.372	0.710
	$FEV_{1.0}$ /FVC	0.80±0.14	0.84±0.096	1.286	0.205
	PEFR	349.00±67.56	367.87±60.70	1.013	0.314
Non-Smokers	$FEV_{1.0}$	3.30±0.50	3.60±0.69	-2.858	0.005*
	FVC	4.01±0.49	4.17±0.49	-1.766	0.078
	$FEV_{1.0}$ /FVC	0.82±0.11	0.86±0.76	-2.214	0.025
	PEFR	371.62±58.01	401.30±48.86	-2.942	0.004*
The Mean Values of Ventilatory Function Parameters of Petrol pump workers by Smoking and Non-Smoking Status.					
Smokers	$FEV_{1.0}$	3.62±0.70	3.49±0.67	0.433	0.788
	FVC	4.30±0.56	4.33±0.62	0.814	-0.236
	$FEV_{1.0}$ /FVC	0.83±0.10	0.81±0.12	0.321	0.999
	PEFR	376.63±66.19	378.12±68.57	0.923	-0.097
Non-Smokers	$FEV_{1.0}$	3.40±0.60	3.70±0.59	0.005	-2.859*
	FVC	4.09±0.59	4.27±0.59	0.079	-1.768
	$FEV_{1.0}$ /FVC	0.83±0.10	0.87± 0.08	0.028	-2.215*
	PEFR	373.63±68.03	404.30±49.89	0.004	-2.944*

* P>0.05; **$FEV_{1.0}$:** Forced expiratory volume in 1st second, **FVC:** Forced vital capacity, **$FEV_{1.0}$/FVC:** Forced expiratory volume, **PEFR:** Peak expiratory flow rate.

Table 5 shows that the mean ventilatory functions parameters in study subjects who were current smokers were lower than that of control subjects who were current smokers except forced expiratory ratio. The differences were statistically not significant for $FEV_{1.0}$, FVC and PEFR but it was statistically significant for $FEV_{1.0}$/FVC ($p<0.05$). Similarly, the mean ventilatory parameters in the study subjects who were ex- smokers were less than the control subjects who were ex-smokers except forced vital capacity. However, in the case of non-smokers, the mean values of the mean ventilatory functions parameters $FEV_{1.0,}$ FVC, $FEV_{1.0}$/FVC and PEFR in petrol pump workers were also lower than that control subjects who were nonsmokers. The Statistically significant difference was observed between workers and control group especially in the case of $FEV_{1.0}$ and PEFR (P value< 0.05).

The mean values of ventilatory function parameters of petrol pump workers by smoking and non-smoking status shows that the FVC and PEFR were marginally reduced in petrol pump workers compared to control subjects in the smoking group. The difference observed was

however not statistically significant whereas in the case of non-smoker group, the mean values of $FEV_{1.0}$, FVC, $FEV_{1.0}$/FVC and PEFR were comparatively less or reduced in the petrol pump workers as compared to control subjects. Statistically significant difference was observed between workers and control group especially in the case of $FEV_{1.0,}$ $FEV_{1.0}$/FVC and PEFR (P value< 0.05).

DISCUSSION

A total of 168 respondents comprising of 84 petrol pump workers and 84 control subjects were used in this study. The age range of the petrol pump workers and control group were between 18 and 60 years of age with a mean age of 25.32±4.52 years 25.74±4.42 years respectively. This is similar to other studies done by Anuj et. al, (2008), Akor – Dewu et. al, (2011), and Madhuri et al (2012). The mean weight and height of petrol pump workers in this study was 63.68±9.40 kg and 1.54±0.08 m respectively while that of control subject was 65.21±9.46 kg and 1.53±0.08 m respectively. This is similar to a study by Madhuri et. al, (2013) in which the mean weight and height for petrol pumps workers and control subjects was 60.90±10.13 kg, 1.68± 0.08 m and 62.67± 8.52 kg, 1.73±0.06 m respectively. The mean BMI of petrol pump workers (26.85±3.80) were less than that of control subject (27.86±3.40), a similar result was also observed in case of textile workers of Uttar Pradesh ((Jaiswal, 2015 and 2018).

Exposure to petrol fumes, in this study among petrol pump workers was evaluated using the work hour per week as petrol pump workers, the duration of employment and the number of vehicles filled per day. This study showed that the mean ventilator function parameters ($FEV_{1.0}$, FVC, $FEV_{1.0}$/FVC and PEFR) of petrol pump workers were lower than that of controls with a significant difference seen in PEFR (p valve 0.03). The mean $FEV_{1.0}$/FVC and PEFR, when the degree of exposure was measured by the duration of employment as petrol pump attendant, were reduced with p values of 0.01 and 0.03 respectively. This is in agreement with others studies done by Anuj et.al, 2008; Madhuri et.al, 2013; Chaugule et.al, 2007; Akor – Dewu et. et. al, 2011; Singhai et. al, 2007; Uzma et. al, 2008; Adeniyi B O et. al, 2013; Rubeena et. al, 2009, More or less a similar result was also observed in case of textile workers of Uttar Pradesh (Jaiswal, 2013 and 2015).

Akor – Dewu et. et. al, (2011) reported a significant reduction in PEFR, FVC in all age groups and a significant reduction in FEV1, in the older age group. Uzma et. al, (2008) reported a significant decrease in all ventilatory function parameters of petrol pump workers who had worked for more than 10yrs. This study also showed significant reductions ($p<0.05$) in the mean values of $FEV_{1.0}$, $FEV_{1.0}$/FVC and PEFR of petrol pump workers in Pondicherry with increase in the number of vehicles filled per day. This finding is similar to a study done by Logorio et. al, (2015) in which the number of vehicles is a significant predictor of exposure in a simple regression analysis. There was statistically significant decrease in $FEV_{1.0}$/FVC and PEFR of petrol pump workers who worked for > 70 hours per week compared to those that worked for <70 hours per week. None of the studies done earlier corroborated or disputed this finding. The predominant abnormal pattern in this study was obstructive. However; both obstructive (16.67%) and restrictive (13.09%) pattern of ventilatory impairment were found. This in agreement with studies done by Akor-Dewu (2011) and Madhuri et. al. (2013).

This study also showed that obstructive pattern is predominant in petrol pump workers who had worked for <15 years but the number of obstructive pattern decreases with increasing duration of

employment. This is contrary to studies by Chaugule et. al, (2007) and Uzma et. al, (2008) which showed that restrictive pattern was predominant in petrol pump workers who had worked for 2 - 10 years and mixed pattern was predominant in petrol pump workers who had worker for >10 yrs. This study however agreed with the fact that long term exposure to petrol fumes cause increased the risk of developing abnormal ventilatory function.

Although most of the previous studies on ventilatory functions in petrol pump workers were done in healthy nonsmokers, this study however showed that the ventilatory parameters ($FEV_{1.0}$, FVC, $FEV_{1.0}$/FVC and PEFR) in petrol pump workers who smoked were not significant lower than that of the controls who smoked. This disagreed with the study done by Anuj et. al, (2008) which found that the effect of smoking as an independent variable significantly affected $FEV_{1.0}$. The difference between this study and the other studies may be explained by the less pack years of cigarette smoking among petrol pump workers in Pondicherry compared to studies done in other areas (Douglas et.al, 2009). The study showed that the effect of cigarette smoking as an independent variable, on respiratory functions of petrol pump workers is influenced by the pack year of smoking.

Conclusion

The study showed that exposure to petrol fumes among petrol pump workers (who had worked for more than one year) had significant effect on their ventilatory function. Also the ventilatory function parameters of petrol station workers were lower than that of control group. Present study also showed that abnormal ventilatory pattern was prevalent in petrol pump workers. The predominant ventilator dysfunction was obstructive.

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REFERENCES

Adeniyi B O, Obaseki D O, Adebayo A M, Erharbo G E. (2013). Pulmonary Function Among Petrol Pump Workers in Ile-Ife, Africa. *Am. Thoracic Society journals*. 2013; 187: 1.

Agnew M. *Spirometry in Clinical use: Practical issues Breath* 2010; 6: 197- 203.

Alakija W, Iyawe V, Jarikire I.N. (1990). Pulmonary function of workers at Okpella Cement Factory. *West Afr J. of Med*. 9(3); 187- 191.

Akor- Dewu M.B, Olorunshola K.V, Bako I.G (2014). Pulmonary function tests among adult male petrol pump workers, *Kaduna State*. 11-14.

American Conference of Government and Industrial Hygienist manual on environmental health. (1993). 1; 18- 24.

Anuj C, Lavania A.K (2008). Air pollution and fuel vapor induced changes in lung functions: Are fuel handlers safe? *Indian J Physiol Pharmacol*. 52(3): 255-261.

Araoye M.O. (2004). Sample size estimation. Research Methodology with Statistic for health and social sciences. *Ilorin Nathadex Publishers*. 59- 99.
Bourke S.J. (2003). *Lecture notes on Respiratory medicine. 6thedition. Blackwell: Berlin*; 145-155.
Bulletin of the W H O. (2006). *Int J. of Pub Health*. 84(6); 495.
Chaugule SS, Nair J, Athavale. (2007). Evaluation of respiratory morbidity in petrol pumps workers in Mumbai. *Indian J Physiol Pharmacol*. 53(4): 224-228.
Douglas G, Nicol F, Robertson C. (2005). *Macleod's Clinical Examination, 11th edition, Edinburgh. Elsevier Churchill 453 Livingstone.* 17.
Erhabor G.E, Fatus A.O, Ndububa D. (1992). Pulmonary symptoms and functions in gas welders. *Nig Med Pract.* 24(5/6); 99- 203.
Erhabor G.E. (2010). Pulmonary function tests: Spirometry and Peak flow in clinical practice. *Asthma and Chest Care Foundation*. 19- 20.
Guldeberg P.H. (1992). Gasoline and vapour exposure in service station and leaking underground storage tank scenario. *J. of Exp Analysis and Envir Epid*. 2; no 1, 97- 107.
Gupta S, Dogra T.D (2002). Air pollution and human health hazard; *Indian J. of Occup Envir Med*. 6; 89- 93.
Ihenacho E.A. (2004). Basic steps for quality research projects. *Noble- Alpha International (Publisher),* 2nd edition. 35-61.
Jaiswal, A. 2013(2013). Assessment of Respiratory Disorders among workers in Cigarette Industry" *Human Biology Review, International Peer Reviewed Journal of Biological Anthropology*. 2(4): 294-305
Jaiswal, A. 2013(2015). An Anthropological and Medical Analysis on Respiratory Problem and Worker's Working Condition' *International Journal of Research in Sociology and Anthropology*. 1:1, 18-28.
Jaiswal, A. 2013(2018). A Cross-Sectional Study on Industrial Health Hazards among Garment Factories Workers of Tamil Nadu" *Asian Man, An International Journal*.12, 1: 29-36.
Lewne M, Nise G,Lind M.L, Gustavsson P. (2006). Exposure to particles and nitrogen dioxide among taxi drivers. *Int Arch occup Envir Health*. 79; 220- 226.
Logorio S, Forastiere F, Lavarone I. (2015). Exposure to Petrol vapor; assessment in historical cohort in filling station attendants. *Oxford Int J. of epid. 22*, supplement 2; 51- 56.
Fletcher C, Peto R. (1977).The natural history of chronic airflow obstructio. *Br Med J.. 1:* 1645-1648.
Maduka S.O, Osim E.E, Nneli R.O, Anyanbolu A.E. (2009). Effect of occupational exposure to local powdered tobacco (snuff). *J. Physiological Sci*. 24(2): 195- 202.
Madhuri B.A, Chandrashekan M (2012). Pulmonary functions in petrol pump workers in Kanchipuram population. *Int J Biol Med Res.* 3(2): 1712-1714.
Medical Research Council Committee on etiology of chronic bronchitis standard questionnaire on respiratory symptoms. *B.M.J.*(1960). 2: 1665- 1668.
Miller M.R, Hankinson J, Brusasco V, (2005). Standardization of Spirometer. *Eur Resp J*. 2005; 26: 319- 338.
Ogakwu M.A.B. (1973). Pilot health survey among Enugu coal miners. *Afr. Med J. 3*(2); 97- 99.
Okwari O.O, Antai A.B, Owo D.U, Peters E.J, Osim E.E. (2005). Lung function status of workers exposed to wood dust in timber. *Afr J. Med Sci.* 34(2): 141- 145.
Oleru V.G (1980). Pulmonary functions of control and industrially exposed Nigerians in asbestos, textile and toluene diisocynate foam factories. *Envir Resp J*. 23; 137- 148.

Pranjic N, Mujagic H, Nurkic M, Karamehic J, Pavlonic S. (2002). Assessment of health effects in workers at gasoline station. *Bosn J. of Basic Med Sci*. 2; 35- 45.
Rowat S.C (1998). Integrated defense system overlaps as a disease model. *Envir health Perspective*. 106; 85- 109.
Rubeena B, Mahagaonkar A.M, Kulkarni N.B, Nadeem A. Nighute S (2009). Study of pulmonary function tests among smokers and non-smokers in a rural area. *Pravara Medical Review*, 2009; 4(1): 11-16.
Singhai M, Khaliq F, Singhai S, Tandon O.P (2007). Pulmonary function on petrol pump workers; a preliminary study. *Indian J Physiol Pharmacol*. 51(3): 244-8.
Udonwa N.E, Uko E.k (2009). Exposure of petrol station attendants and auto mechanics to gasoline fumes in Calabar. *J. of Envir and Pub Health*. 23- 28.
Uzma N, Salar Mohinuddin Khaja B.M, Kumar B.S, Aziz N, David M.A, Reddy V.D. (2008). Impact of organic solvents and environmental pollutants on the physiological functions in petrol filling workers; *Int J Environ Res Public Health.* 5(3): 139-46.
W H O Report (2008). Tobacco Could Kill One Billion by 2100, *Sciences Daily.* 24; 71.
Zejda J.E. (1996). Effect of occupational exposure to workers. *Int J. Occup Med Envir Health.* 9(2):117-125.