

Pulmonary Function Test in Car Wash Workers of Karachi, Pakistan

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Abstract

Introduction: Car wash industry comprises a wide source of employment in an urban city like Karachi. The use of chemicals during car wash may deteriorate the internal functions particularly of lungs. The aim of our study is to determine the effects of these chemicals on lung function test.

Objectives: To determine the association of car wash workers and their pulmonary function.

Method: The study was conducted in Karachi, during the period of January 2014 to July 2014. It is a cross sectional study in which questionnaire was filled and pulmonary function test (PFT) of the individuals working in a car wash stations was performed. The vitalograph was used to find out the PFT.

Results: It was observed that due to exogenous inhalation in car wash area the individuals working there are badly affected as far as their lung functions are considered. It was observed that forced expiratory volume (FEV) and peak expiratory flow rate (PEFR) is significantly reduced (0.000), (0.001) respectively at $p < 0.01$.

Conclusion: The pulmonary function test is significantly affected in car wash workers and they are at risk of various pulmonary diseases. It is suggested that they should use mask and also take other measures during work.

Keywords: PFT; Spirometer; Car wash workers

Introduction

The adverse effect of air and environmental pollution are ubiquitous in literature. It is estimated by United Nation that around 47% of the global population reside in cities which ultimately increasing the vehicle released pollutants. The United Nation Environmental Program has identified this type of pollution as the most alarming air pollution [1]. Humans are exposed to organic and inorganic pollutant through environmental and occupational sources. Epidemiological evidences shows link between exposure to occupational and non-occupational pollutants and risk of cancer [2]. The people who are at risk of occupational pollution belongs mainly to color industry, chemical industry, glass industry, cotton fiber industry. There are various occupations and risk factors associated with pollution which are either not highlighted or neglected.

The efforts of becoming developed country causing the heavy growth of industries especially automotive industries in all around the world. In order to avail luxurious life style, the demand to have car from better to best is increasing. The large scale production from automotive industries and use of cars in urban cities causes the emergence of car wash industries. It is found that European and United States manufacturers are installing minimum 50 car wash systems per year which shows the demand of cleaning cars [3]. The common things which accumulate on the surface of car include road dust, grime, rust stains, and films from brakes. Majority of the car washing chemicals

contain hydrogen fluoride due to its ability to dissolve dust, rust and stains [4]. Car washing workers are usually unaware about the toxicity of various chemicals used in this industry and are exposed either by inhalation, oral, dermal and ocular contact with these chemicals. The effect of various chemicals of car cleaning, diesel fumes, diesel exposure and diesel inhalation on human health got little attention by the scientist and researchers. The employees of car wash stations are exposed to diesel directly when they use mixture of water and diesel to spray, diesel exhaust material washed out from engine and vehicles and liquid diesel for direct hand washing. Diesel exposure in any mean not only effect the people working around machines but also effect the people who are living near heavy traffic roads. These people have irritant respiratory symptoms and are at risk of having other pulmonary diseases like allergy [5], lung cancer [6,7], chronic obstructive pulmonary diseases [8,9] etc. The people working at petrol pumps especially in the car washing area are the most neglected people whose health related matters have not been studied extensively. Car wash industry employees are the large labor force in an urban city like Karachi. Car wash facilities are provided not only on fuel station but also in independently running workshops. Wastewater from car washing stations contains a number of impurities such as sand and dust, free oil, grease, oil/water emulsion, carbon, asphalt, salts, surfactants and organic matter, which is discharged directly into municipal sewage treatment plant [10]. Occupational health hazard poses grave risk to health of the employees. In a report (2006) from California Coalition for Worker Occupational Safety and Health Protection (Cal-COSH) detailed the types of occupational safety and

health violations that occur in California’s carwashes, including a description of the toxic exposures to which carwash workers are subjected to on the job. They described the toxic chemicals that car wash workers are exposed to during every stage of car wash process. One of many chemicals which were mentioned was quartz, which is carcinogenic and found in carnauba wax. Improper exposure to quartz can cause damage to the central nervous system as well as the lungs, liver, and kidneys. Common carwash products can irritate the respiratory tract, skin, and eyes, and may cause liver, kidney, and heart damage. If inhaled, some products can lead to headaches, convulsions, blindness, or even death. Car cleaning product designed for wheel cleaning contain highly toxic chemicals including hydrogen fluoride. Hydrogen fluoride is powerful enough to etch glass, and is used to pre-treat cars before shampooing. In addition it is also used in wheel cleaning. Hydrogen fluoride is highly corrosive and toxic; is irritating to the skin, eyes, and mucous membranes; and can cause respiratory irritation and hemorrhaging. Cal -Cosh advises protective gear such as masks and respirators to avoid inhalation of harsh chemicals along with goggles, gloves and anti-slip footwear. However, practice of precautionary methods is next to non-existent in car wash centers around Karachi. Lack of awareness and negligence of personal safety is taking heavy toll on the health of the workers.

This research aims to evaluate pulmonary function of individuals employed in car wash stations. It will highlight the effect of respiratory irritants on car wash workers. Additionally, it will help assessing the degree of harm caused by regular exposure to toxic chemicals and will bring realization of the need to practice appropriate precaution during work. Research will also assist health care providers to devise an effective health care program pertinent to the problems faced by car wash workers.

Methodology

This study was conducted in Karachi Pakistan during the period of January to July 2014. It is a cross sectional study. The sample size as calculated by open epi.com is 130 each control and test. The controls were selected from the same area where the car wash centers are situated. The controls were matched for age, height, weight and the histories. The samples were collected by convenient non- random sampling technique via filling out questionnaire and performing Spirometric based test by Vitalograph. The questionnaire was made by the supervisor and was approved by institutional review board (IRB) of institute. It consists of demographic picture like age, socioeconomic condition, occupational history, and smoking history. All subjects were males older than 15 years and working on car wash stations for more than 6 months. The subjects with any known pulmonary diseases are excluded in this study. Data was collected by convenient non- random sampling technique. Informed consent was obtained from each subject prior to study. Questionnaires were filled from both workers and controls. Once these questionnaires were completed, all subjects (controls and test) were instructed to perform the forced expiratory maneuver (for at least 6 s) using the COPd-6 device (Model 3842, Vitalograph, Ennis, Ireland).

Vitalograph which is a portable and digital device it calculates FVC, FEV1, FEV1% and PEF, along with other tools like Weighing machine, measuring tape and nose clip. The individuals performing the test were prior trained on vitalograph testing. The person tested was asked to take a deep breath and released it in the mouthpiece. A measurement was considered as satisfactory when a beep sound was observed, it indicates that expiration of at least 6 sec had been completed. If the beep was not produce it was rejected as unacceptable. At least three measurements were recorded for each subject and average was taken. As smoking was considered as confounding factor for the study so it was included in both the groups (Controls and cases). If the results were altered due to this factor it would also appears same for both groups.

Data analysis was done on SPSS 16 version to calculate mean, percentages and Chi square test to see the significance of study. Research is conducted by keeping in view the ethical consideration. It is approved by institutional ethical research committee. Permission was taken from car wash station manager and the worker individually. All the participants gave their informed consent prior to their inclusion in the study.

Results

This is a cross sectional study comprises of 130 males working in a car wash stations and 130 controls not related to this profession. Only those individuals were included in the study who gave the consent and according to our criteria, we contacted 290 individuals among them 260 were agree to participate in the study (collectively both controls and cases), so the response rate is 86%. The mean age of controls and cases were 28 ± 11yrs and 29 ± 10 yrs. respectively. The duty hours of individuals are shown in graph1. The Vital Capacity was significantly affected in individuals working for >12 hrs. in car wash stations (table1).

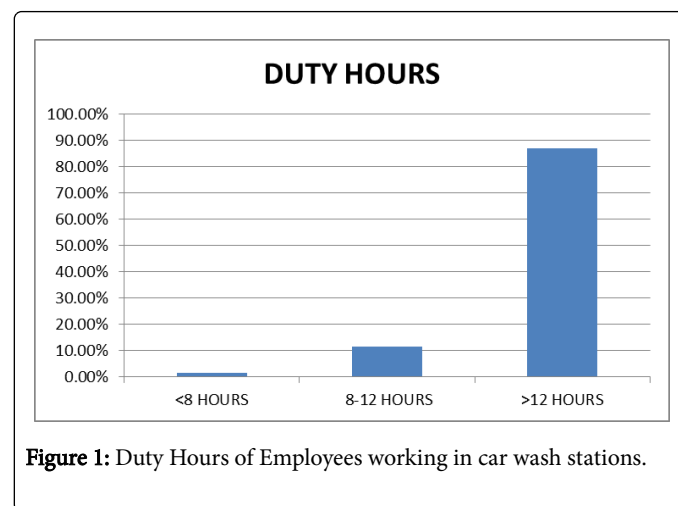


Figure 1: Duty Hours of Employees working in car wash stations.

	< 8 hrs.		8 - 12 hrs.		>12 hrs.		P- Value
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
VC	3.93	0.08	3.98	0.27	4.24	0.23	0.22*

FVC	3.00	0.51	2.81	0.78	2.80	0.84	0.94
FEV1	2.65	0.41	2.45	1.04	2.22	1.03	0.62
PEFR	279.50	96.87	247.13	156.640	234.66	129.19	0.76
FEV1 %	89.90	1.51	83.93	21.32	77.43	26.77	0.48
P< 0.05*							

Table 1: Mean Standard Deviation and P value of pulmonary function test of different duty hours of employees.

The pulmonary function test was performed through vitalograph. The reading for total vital capacity (TVC), Forced volume capacity (FVC), Forced volume capacity in 1 minute, forced expiratory volume (FEV) and peak expiratory flow rate (PEFR) were noted which showed that there was highly significant difference between the cases and control group (table 2).

Variables	Control	Case	F	Significance
TVC	4.203(+/-0.318)	3.112(+/-0.780)	14.907	0.000**
FVC	3.0657(+/-0.794)	3.1146(+/-0.777)	.0.506	0.613
FEV 1	2.8018(+/-08.49)	4.7148(+/-25.44)	.0.857	0.392
PEFR	298.15(+/-119.675)	255.78(+/-93.48)	3.221	0.001**
FEV	88.50(+/-14.870)	81.93(+/-11.175)	4.065	0.000**

**Significant at p< 0.01

Table 2: Mean, Standard error and p values of pulmonary function test for controls and cases.

The symptoms and factors related to altered pulmonary functions were also studied and it was observed that smoking, cough, Shortness of breath (SOB) with walking and exposure to gases affects substantially on the pulmonary functions (Table 3).

	Control (%)	Case (%)	Chi square Test
Smoking	15.4	26.9	0.010**
Cough	2.3	11.9	0.002**
SOB	2.3	8.2	0.038**
SOB on Walk	3.1	11.9	0.005**
Chest	0.8	3.7	0.160
Expose Gas	1.5	7.5	0.040**

**Significant at < 0.01

Table 3: Factors Affecting the Pulmonary function in car wash workers.

Discussion

Occupational health is found to be involved in causation of disease condition due to the reason that long term exposure can lead to a permanent morbidity. Professional carwashes can have an adverse impact on the environment and as well as to the health if not properly managed. The peak expiratory flow rate in our study was found to be lower which means that the ability of car wash workers to breathe out air is lower than normal and they are either having or at risk of Asthma. They have some level of obstruction in their airway. The same results were observed in a study performed on metal welding workers in Pakistan [11]. The diesel and vehicle exhaust might be a reason of increasing self-reported asthma patients as Asthma is prevalent in the urban areas of developed countries. It is confirmed by the Centers for Disease Control and Prevention that there is an increase of about 75%

individuals who reported asthma [12]. Environmental pollution and its adverse effects on human health should be taken quite seriously. Till date there is no report of this type available in the literature from Pakistan. From our study it was observed that pulmonary function is significantly altered in the individuals working in car wash stations. In a report the COHb blood level of indoor car wash facility employees are directly impacted and gets elevated by motor vehicle exhaust emissions [13]. Hydrofluoric acid (HF) which is used in car polishing is the strongest inorganic acid used in industries for metal and glass cleaning also as rust remover [14]. Car wash companies operating within one or more of the following categories: Hand wash, self-serve; in-bay automatic (also known as stationary automatic or roll-over); and conveyor. However, 'Hand car wash' is the predominant method of cleaning cars, observed in service stations all over Karachi. 'Hand wash' is the most labor intensive method of cleaning cars. In some

countries like Turkey, indoor car wash stations were made in some shopping malls. The employees of indoor car wash stations are found to be affected by vehicle exhaust emissions and their carboxyhemoglobin (COHb) level was observed high [15].

The study on PFTs was done previously by the author on the people working in petrol pump and CNG stations and the results also shown that the significant difference in the lung function test results of petrol pump workers from the control [16-19]

Conclusion

The workers of car washing business are at high risk of having pulmonary diseases. Majority of the workers do not know the toxicity of chemicals. Car washing industries and/or private workshops are often located in close proximity of private residences, schools, and parks. This can also cause the harm to community's health. It is very important to alert the employees on such facilities about their health issue.

References

1. Sydbom A, Blomberg A, Parnia S, Stenfors N, Sandström T, et al. (2014) Health effects of diesel exhaust emissions. See comment in PubMed Commons below *Eur Respir J* 17: 733-746.
2. Lipsett M, Campleman S (1999) Occupational exposure to diesel exhaust and lung cancer: a meta-analysis. See comment in PubMed Commons below *Am J Public Health* 89: 1009-1017.
3. Genuino HC, Opembe NN (2012). "A review of hydrofluoric acid and its use in the car wash industry." *Journal of Industrial and Engineering Chemistry* 18(5): 1529-1539.
4. Strachan J (1999) A deadly rinse: the dangers of hydrofluoric acid, Professional Car washing and Detailing.
5. Riedl M, Diaz-Sanchez D (2005) Biology of diesel exhaust effects on respiratory function. See comment in PubMed Commons below *J Allergy Clin Immunol* 115: 221-228.
6. Pedeli X, Hoek G, Katsouyanni K (2011) Risk assessment of diesel exhaust and lung cancer: combining human and animal studies after adjustment for biases in epidemiological studies. *Environ Health*, 10:30.
7. (1989) IARC monographs on the evaluation of carcinogenic risks to humans. Diesel and gasoline engine exhausts and some nitroarenes. International Agency for Research on Cancer. See comment in PubMed Commons below *IARC Monogr Eval Carcinog Risks Hum* 46: 1-458.
8. Hart JE, Eisen EA, Laden F (2012) Occupational diesel exhaust exposure as a risk factor for chronic obstructive pulmonary disease. See comment in PubMed Commons below *Curr Opin Pulm Med* 18: 151-154.
9. Hart JE, Laden F, Eisen EA, Smith TJ, Garshick E (2009) Chronic obstructive pulmonary disease mortality in railroad workers. *Occup Environ Med*, 66:221-226.
10. Bhatti ZA, Mahmood Q, et al. (2011) "Chemical oxidation of carwash industry wastewater as an effort to decrease water pollution." *Physics and Chemistry of the Earth, Parts A/B/C* 36(9-11): 465-469.
11. Meo SA, Al-Drees AM, Rasheed S, Meo IM, Khan MM, et al. (2009) Effect of duration of exposure to polluted air environment on lung function in subjects exposed to crude oil spill into sea water. See comment in PubMed Commons below *Int J Occup Med Environ Health* 22: 35-41.
12. Pandya RJ, Solomon G, Kinner A, Balmes JR (2002) Diesel exhaust and asthma: hypotheses and molecular mechanisms of action. See comment in PubMed Commons below *Environ Health Perspect* 110 Suppl 1: 103-112.
13. Topacoglu H, Katsakoglou S, Ipekci A (2014) Effect of exhaust emissions on carbon monoxide levels in employees working at indoor car wash facilities. See comment in PubMed Commons below *Hippokratia* 18: 37-39.
14. DiLuigi KJ (2001) Hydrofluoric acid burns. See comment in PubMed Commons below *Am J Nurs* 101: 24AAA-24DDD.
15. Cal-COSH, "Car wash workers: the hazards of carwash work and how to reduce or eliminate them," (Cal-COSH, unpublished paper, 2006)
16. Martin HC, Muller MJ (2002) Hydrofluoric acid burns from a household rust remover. See comment in PubMed Commons below *Med J Aust* 176: 296.
17. Olsson AC, Gustavsson P, Kromhout H, Peters S, Vermeulen R, et al. (2011) Exposure to diesel motor exhaust and lung cancer risk in a pooled analysis from case-control studies in Europe and Canada. *Am J Respir Crit Care Med*, 183:941-948.
18. Rutaba A, Zafar A, Ghafoor A, Naseem A, Ali Q, et al. (2014) "lung function abnormalities among fuel filling workers in karachi, pakistan" *Pinnacle Environmental & Earth Sciences*, Vol. 1:183-187.