



Spirometric evaluation of traffic police personnel exposed to high altitudes

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ABSTRACT

The work environment constitutes an important part of mans total environment, so health to large extend is affected by work conditions. In present study was conducted to find out the whether high altitude can modify respiratory function and bronchial responsiveness, physical exertion worsen asthma or enhance bronchial hyper responsiveness while a reduction in pollen and pollution may play an important role in reducing bronchial inflammation . Predicted values of FVC, FEV11, FEV11/FVC and PEF show statistically significant values by F Test (F-value>1.75), However the measured and percentage of predicted values of FVC, FEV11, FEV11/FVC & PEF do not show any statistically significant values. The comparison between Spirometric parameters of Traffic Policemen above 4000ft & Traffic Policemen below 4000ft. In table 2, Measured values of FVC, FEV1, FEV1/FVC and PEF are statistically significant showing higher values in Traffic Policemen above 4000ft (F Value > 1.53) . Percentage of predicted values of FEV1 also show significant values. Predicted and percentage of predicted values of FVC, FEV11/FVC and PEF do not show any statistically significant value. The study concludes with recommendation for rotation of duties of those traffic police working at highway, use of personal protective equipments like nose mask and Inculcation of spirometric evaluation in annual medical check up.

KEY WORDS- Spirometry, traffic police, Pilot Study.

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Introduction

health hazards get more severe when the duration of exposure increases. This fact is more important in situations as the personnel engaged in traffic duty. These personnel have to undergo physical strains in an environment polluted by fumes, exhaust of vehicles, and blow of dust in the air by a speeding vehicle, etc.

In order to study the health hazards of automobile exhausts on human systems, especially respiratory system, the section of the population considered most suitable for study was the traffic police personnel who are posted at various traffic junctions at higher altitudes, as well as at the foot hills of the Himalaya(1)

Spirometric evaluation in traffic police has been extensively studied and showed significant changes with the picture of restrictive abnormalities. Also studies carried

out on natives at high altitude showed increased spirometric values. But spirometric evaluation in traffic police in relation to various altitudes is a challenge as it is not very extensively studied.

Himachal Pradesh is the state where various Himalayan ranges are located. The climate in the Himalayas ranges from tropical at the base of the mountains to permanent ice and snow at the highest elevation. The mountains not only change the environment at various altitudes but also bring about adaptive changes both anatomically and physiologically.

Recognising the gravity of air pollution and its impact on traffic policemen, the Delhi Traffic Police had pioneered three studies in the early '90s. All the three studies revealed that traffic policemen working in

adverse environmental conditions are affected; both in the short and long run, and their health and efficiency are impacted(3).

In present study various other factors are to be taken in to considerations, as the high altitude climate can modify respiratory function and bronchial responsiveness, physical exertion may worsen asthma or enhance bronchial hyperresponsiveness while a reduction in pollen and pollution may play an important role in reducing bronchial inflammation (4).

The study was conducted with the aim to evaluate the Spirometric parameters in the traffic police working in Himalayan region, compare Spirometric changes in relation to various altitude among traffic police working in Himalayan region and to identify high risk group of traffic police so as offer necessary suggestions regarding protective measure for police personnel deployed on traffic duty.

Methods and Material

The present study on Traffic Policemen (TP) was conducted in the Department of Physiology & Department of Pulmonary medicine in Dr. R.P.G.M. College and Hospital, Kangra at Tanda with prior permission from the Institutional Ethical Committee and from superintendent of police, Kangra.

The study group consisted of (55 Traffic Policemen working at altitude below 4000ft, 35 Traffic Policemen working at altitude above 4000ft and 30 Non-Traffic Policemen as controls). Traffic police with history of smoking for more than 6 months and with history of any major respiratory disorder were excluded from the study. Also traffic police with less than 3 months in traffic duty were excluded.

The Subjects included in the study were as following:-

- Group I = Traffic Policemen working**
 - At altitude below 4000ft. n = 55**
- Group II = Traffic Policemen working**
 - At altitude above 4000ft. n = 35**
- Group III = Non-Traffic Policemen**
 - i.e. Controls n = 30**

Detailed clinical history of the subjects was obtained based on the Respirator Medical Evaluation Questionnaire (OSHA 1998) (5) and subjects underwent thorough physical examination. Routine haematological tests were all so carried out. Pulmonary function tests were done on

Spirolab III. The spirometer gives two values, predicted and measured.

The Spirolab III Software uses a set of prediction equations for the adults and calculates the predicted values.

Before the test age, height and weight of the subject was entered in the computerized spirometer. Testing was done in sitting position. The subjects were explained the procedure before testing. Best of the three performances of FVC, FEV₁, FEV₁/FVC & PEF was taken into account. ANOVA test was done to find the difference among the 3 groups.

Results:

In table 1, Predicted values of FVC, FEV₁, FEV₁/FVC and PEF show statistically significant values by F Test (F-value>1.75), However the measured and percentage of predicted values of FVC, FEV₁, FEV₁/FVC & PEF do not show any statistically significant values. Table (II) Shows the comparison between spirometric parameters of Traffic Policemen above 4000ft & Traffic Policemen below 4000ft. In table 2, Measured values of FVC, FEV₁, FEV₁/FVC and PEF are statistically significant showing higher values in Traffic Policemen above 4000ft (F Value > 1.53). Percentage of predicted values of FEV₁ also show significant values. Predicted and percentage of predicted values of FVC, FEV₁/FVC and PEF do not show any statistically significant value.

Discussion: Fundamentally important to occupational performance at altitude is maintaining the oxygen supply to the tissues. We (and other animals) have defences against low oxygen states (hypoxia). Chief among these is an increase in breathing (ventilation), which begins when the oxygen pressure in the arterial blood (po₂) decreases (hypoxemia), & is present for all altitudes above sea level, is progressive with altitude. The oxygen pressure in the arterial blood is higher in acclimatized subjects than in un-acclimatized subjects (6)

The mountain climate can modify respiratory functions and bronchial responsiveness. Natives are born at these altitudes and live there all their lives. In all aspects of acclimatization the natives are superior to even the best acclimatized lowlander. Acclimatization of the natives begins in infancy. The chest size, especially is greatly increased, where as the body size is somewhat decreased giving a high ratio of ventilatory capacity to body mass. Also oxygen transport to the tissues is exceedingly effective in the naturally acclimatized high-altitude natives. (7).The study group includes Traffic Policemen from altitudes varying from 500 ft to 9000 ft. And these Traffic Policemen are natives from the district Kangra. The pulmonary function tests were carried out in Traffic Police

Table 1: Comparison of parameters between Traffic policemen & Controls

Sr. No.	Parameters	T.P. (n = 90)		Controls (n = 30)		F. Test
		Mean	Variance	Mean	Variance	
1	FVC (L)					
	Predicted	4.12	0.12	4.01	0.22	<u>1.76</u>
	Measured	3.74	0.28	3.63	0.30	1.11
	% Predicted	90.98	105.55	90.67	83.61	1.26
2	FEV ₁ (L)					
	Predicted	3.41	0.09	3.32	1.78	<u>2.01</u>
	Measured	3.46	0.23	3.29	0.25	1.09
	% Predicted	101.84	127.26	99.1	132.02	1.04
3	FEV ₁ /FVC					
	Predicted	80.01	1.27	80.07	2.98	<u>2.35</u>
	Measured	92.66	29.72	90.58	33.79	1.14
	% Predicted	115.82	46.53	113.2	57.89	1.24
4	PEF (L/S)					
	Predicted	9.04	0.23	8.92	0.47	<u>2.02</u>
	Measured	7.74	3.68	7.60	4.77	1.30
	% Predicted	85.38	396.66	85.43	569.43	1.44

Table 2: Comparison between Traffic Police above 4000 feet & Traffic Police below 4000 feet.

Sr. No.	Parameter	TP> 4000ft. n = 35		TP< 4000 ft. n = 55		F. test
		Mean ()	Variance	Mean	Variance	
1	FVC (L)					
	Predicted	4.12	0.11	4.12	0.13	1.24
	Measured	3.84	0.17	3.75	0.34	<u>1.99</u>
	% Predicted	91.02	90.55	90.94	116.94	1.29
2	FEV ₁ (L)					
	Predicted	3.41	0.08	3.40	0.09	1.11
	Measured	3.53	0.15	3.42	0.27	<u>1.76</u>
	% Predicted	103.88	90.34	100.54	148.43	<u>1.64</u>
3	FEV ₁ /FVC					
	Predicted	80.09	1.52	79.95	1.12	1.35
	Measured	94.60	20.35	91.41	32.15	<u>1.57</u>
	% Predicted	118.14	34.30	114.34	49.37	1.43
4	PEF (L/S)					
	Predicted	9.05	0.21	9.03	0.24	1.12
	Measured	7.95	4.03	7.59	3.4	<u>1.62</u>
	% Predicted	87.62	422.00	83.94	382.68	1.10

men above 4000 ft. and Traffic Policemen below 4000 ft. and in controls. The comparison is based on F Test. When total Traffic Policemen were compared with the controls it was observed that the measured values and percentage of predicted values in both groups are non-significant. Perhaps, this absence of significance resulted from various factors.

Traffic Police above 4000 ft show higher FVC and FEV₁, but the Traffic Police below 4000 ft. have lower values. The natives at high altitude have higher values of spirometric parameter. The FVC and FEV₁, are higher in Sherpa's, who are natives at 3840m altitudes, as was suggested by Andrian P. Havryk *et al* (2002)(8).

Similar non significant results were also reported by Kanae Karita Eiji Yano *et al* (2001) in the traffic police in Bangkok (9) but Sopan T. Ingle *et al* (2005) show that there is a significant reduction in the lung volumes with restrictive changes in the traffic police of Jalgaon city (2).

Other factors also contributes to our results are the vehicular density is lower in the Himalayan belt as well as the ambient environmental pollution is less as there is high degree of plantation and forests.

We also compared the parameters in Traffic Police above 4000ft and Traffic Police below 4000ft with significant

tly higher values of the parameters in Traffic Police above 4000ft. This implies that parameter of Traffic Police at higher altitude are less affected because they show increase FVC & FEV1, this is due to adaptation to hypoxic environment as the native are well acclimatized and have higher ventilatory capacities and hence oxygen transport to the tissues is exceedingly effective (10) and they are also habituated to high degree of strenuous exercise due to the archaeology in the hills.

The Traffic Police working at altitudes below 4000ft are more affected because of higher vehicular density at the National Highways and at various other junctions. Also at the foot hills of Himalaya the flora and Fauna is different with less density of forest.

Apart from this, out of the total 90 Traffic Policemen examined 7 of them have mild restrictive changes i.e. about 8% of the Traffic Policemen are affected. This implies that the vehicular pollution definitely has conspicuous impact on the lung volumes.

Road traffic produce volatile organic compounds, suspended particulate matter (SPM), oxides of sulphur (SO_x), oxides of nitrogen (NO_x), and carbon monoxide (CO), which makes adverse health effects on the exposed population(2). WHO's recent systematic review of the health aspects of air pollution in Europe assessed this evidence, focusing on the health effects of PM, ozone and nitrogen dioxide (9). According to G. Thippanna and Sudeep Lakhtakia 0.9% of the constables were found to be having severe restrictive ventilatory defect, 5.9% having moderate and 18.6% having mild degree of respiratory restriction(1).

Recognising the gravity of air pollution and its impact on traffic policemen, the Delhi Traffic Police had pioneered three studies in the early '90s. All the three studies revealed that traffic policemen working in adverse environmental conditions are affected; both in the short and long run, and their health and efficiency are impacted. Taking into consideration these problems the Delhi Traffic Police Joined hands with NGO 'Better Breathers Club of India' (BBCI) to observe 'World Asthma Day' (WAD) and embarked on a continual programme of check-ups, diagnosis and treatment for traffic policemen with likely respiratory and other ailments contracted while performing duty at high-pollution traffic junctions. (3)

Rotation of duties of those Traffic Policemen working on the National Highway and working at traffic junction with higher vehicular density is required even in the Himalayan belt. Hence, the suggestion regarding protective measures was given to the Superintendent of Police of District Kangra.

Conclusion:

It does appear that traffic police constables are a high risk group in the population who are very likely to develop respiratory dysfunction from high altitudes.

Suggestions are given to the police officials like:

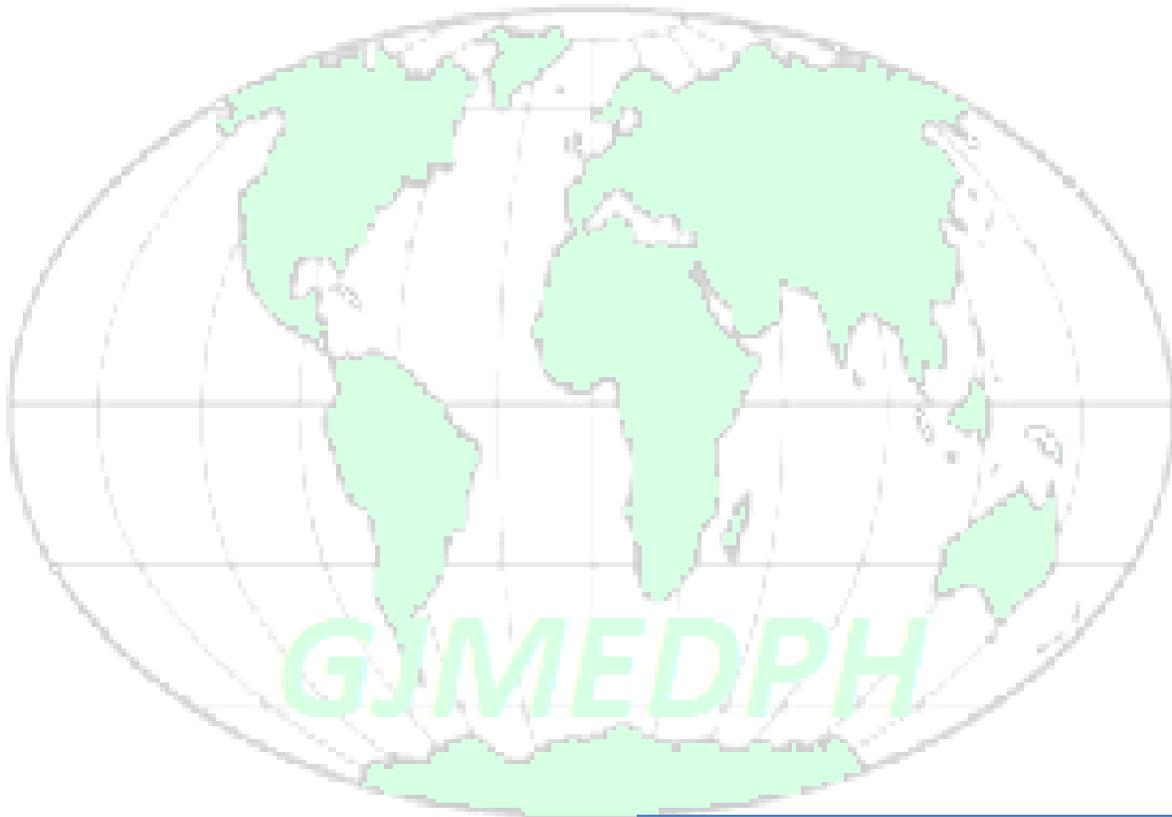
1. Rotation of duties of those traffic police working at highway.
2. Use of personal protective equipments like nose mask.
3. Inculcation of spirometric evaluation in annual medical check up.
4. Personal habits like smoking must be taken in to consideration while posting the traffic police as smokers have higher risk of obstructive lung disorders.
5. To join hands with NGO "better breather club of India (BBCI)" to observe 'World Asthma Day' (WAD) and embarked on a continual programme of check-ups, diagnosis and treatment for traffic policemen with likely respiratory and other ailments contracted while performing duty at high-pollution traffic junctions.
6. Regular breathing exercise for all traffic police.

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