Original Article

ID: JCDR/3940:1997

Physiology Section

Effect of Occupational Exposure to Pollutants on Peak Expiratory flow Rate of Healthy Non-smoking Bus Drivers in the Age Group of 20-55 Years

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ABSTRACT

Objective: The present study was undertaken to establish the effect of pollutants in the form of auto-exhaust, gases, etc. on the respiratory airways of healthy, non-smoking bus drivers in the age group of 20-55 years, by measuring the peak expiratory flow rate (PEFR) values.

Materials and Methods: One hundred healthy, non-smoking bus drivers in the age group of 20 years to 55 years. were selected randomly from a bus stand of the PRTC (Punjab Roadways Transport Corporation) in the Patiala district and their PEFR values were compared with those of one hundred healthy, non-smoking persons in the age group of 20 years to 55 years, who were engaged in professions other than bus driving. Subjects with a prior history of reactive airways or bronchodilator intake were excluded. The influence of age, height, weight, body surface area and the duration of exposure on PEFR were studied. The PEFR test was performed by using Mini Wright's Peak Flow Meter.

Results: The mean PEFR of the bus drivers was found to be less than that of the control subjects in each group and the results were found to be statistically highly significant ($p<0.005$). This decrease in the PEFR in the bus drivers was probably due to their continuous occupational exposure to pollutants, which may have caused an adverse effect on their respiratory functions.

Conclusion: There was a significant decrease in the lung functions of the bus drivers, as compared to those of the controls.

Key Words: PEFR, Lung Functions, Bus Drivers, Peak Expiratory Flow, Mini Wright's Peak Flow Meter, Respiratory Airways

INTRODUCTION

Since the past few years, there has been an enormous increase in the use of automobile vehicles i.e. buses, trucks, cars, etc. in India, especially in the urban areas, due to which there has been an increase in the number of air pollutants in the form of oxides of nitrogen, suspended particulate matter, carbon dioxide, carbon monoxide, lead, sulphur dioxide, aldehydes, polynuclear aromatic hydrocarbons, etc., which may be potential hazards which contribute to the development of respiratory ailments in people who are at work, especially in bus drivers. Among these pollutants, the oxides of nitrogen are respiratory toxicants (Darke et al, 1958) [1]. The WHO technical report of 1969 stated that automobile exhaust was an important irritant in most instances, which affected the respiratory tract. It is essential to detect and treat respiratory obstruction at an early and reversible stage for the prevention of permanent damage. In the persons who are exposed to these pollutants, pulmonary function tests are used as screening tests to determine their effects [2]. The peak expiratory flow rate (PEFR) is one such parameter that can be easily measured [3].

The present study was undertaken to establish the effect of pollutants in the form of auto exhaust, gases, etc on the respiratory airways of healthy, non-smoking bus drivers in the age group of 20-55 years, by measuring their peak expiratory flow rate (PEFR) values.

MATERIALS AND METHODS

One hundred healthy, non-smoking bus drivers in the age group of 20 years to 55 years were selected randomly from a bus stand of the PRTC (Punjab Road Transport Corporation) in Patiala district. Subjects with a prior history of reactive airways or bronchodilator intake were excluded. One hundred healthy, non-smoking persons in the age group of 20 years to 55 years, who were engaged in professions other than bus driving, were selected and they were taken as the control subjects. Both the study and the control subjects were divided into subgroups according to their age, height, weight, body surface area and the duration of exposure of the pollutants. Their PEFR was recorded by using a MINI WRIGHT PEAK FLOW METER and their values were compared with those of the control group.

MINI WRIGHT PEAK FLOW METER

A relatively simple, inexpensive and easily portable instrument called a MINI WRIGHT PEAK FLOW METER was used for this study.

RESULTS

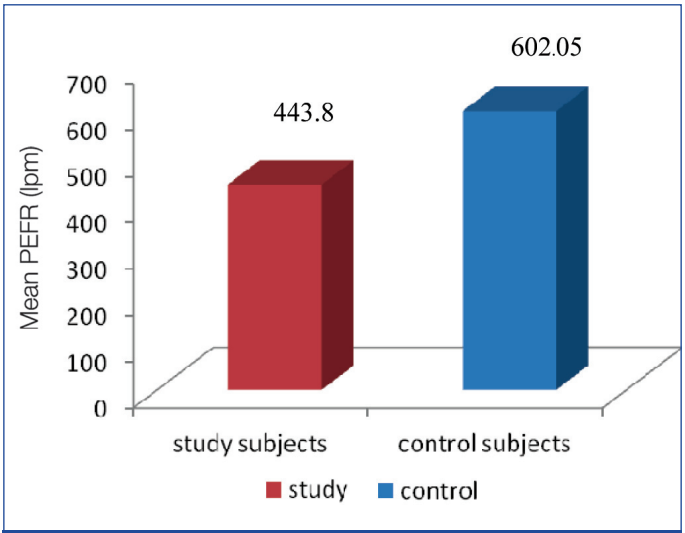
According to age, height, weight and body surface area divided in different groups, the mean PEFR of the bus drivers was found to be less than that of the control subjects [Table/Fig-1] and [Table/Fig-2] in each group and the results were found to be statistically

Subjects	Range of PEFR (in litres/min.)	Mean ± SD of PEFR (in litres/min.)	't' value	'p' value	Significance
Study	300–570	443.87 ± 46.94	-18.76	<0.005	HS
Control	402–745	602.05 ± 70.01			

[Table/Fig-1]: Comparison of Mean and SD of PEFR in study and control subjects

highly significant.

This decrease of the PEFR in the bus drivers was probably due to their continuous occupational exposure to pollutants, which may have caused an adverse effect on their respiratory functions.



[Table/Fig-2]: Bar diagram showing comparison of mean PEFR in study and control subjects (lpm-litres per minute)

DISCUSSION

The PEFR is an effort dependent parameter which emerges from the large airways within about 100-120 ms of the start of the forced expiration [4]. It remains at its peak for about 10 ms [5].

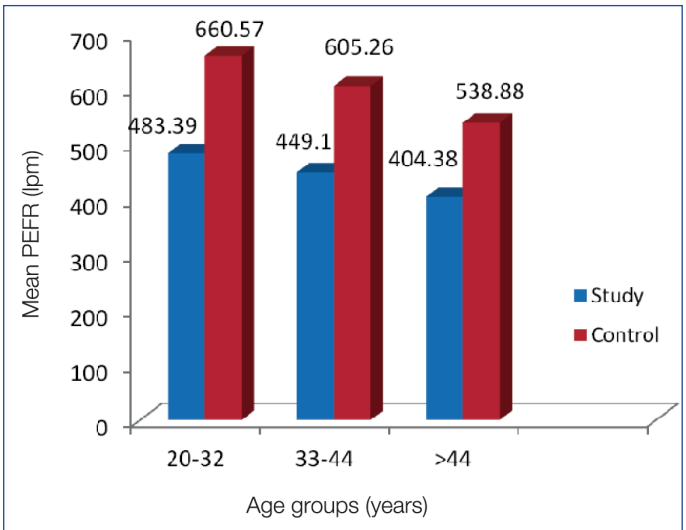
The PEFR is helpful in evaluating the extent and the rate of progression of the disease process (Shah and Mehta, 1961) [6].

The present study was undertaken to establish the effect of pollutants in the form of auto-exhaust, etc on the respiratory airways of bus drivers by measuring their PEFR values. The comparison of the PEFR in the study and control subjects was done by using the data which was collected. Also, the influence of age, height, weight, body surface area and the duration of exposure of the pollutants on the PEFR of bus drivers were studied.

PEFR and Age: The present study revealed that the mean PEFR in the study subjects had decreased with an increase in age. The results were in accordance with those of a study which was done by Rao et al. 1992 [7]. When the mean PEFR of the study subjects was compared with that of the control subjects according to the three age groups, the mean PEFR of the study subjects was found to be less than that of the control subjects in each group and the results were found to be statistically highly significant. [Table/Fig 3] and [Table/Fig-4]

Age groups (in yrs.)	Study		Control		't' value	'p' value	s
	No. of sub.	Mean ± SD of PEFR (in litres/min.)	No. of sub.	Mean ± SD of PEFR (in litres/min.)			
20 –32	33	483.39±31.76	35	660.57±48.72	-17.86	< 0.005	HS
33 – 44	30	449.1±38.98	31	605.26±33.51	-16.75	< 0.005	HS
≥45	37	404.38±29.69	34	538.88±59.03	-11.96	< 0.005	HS

[Table/Fig-3]: Comparison of Mean and SD of PEFR in study and control subjects according to age groups



[Table/Fig-4]: Bar diagram showing comparison of Mean PEFR in study and control subjects according to age groups (lpm- litres per minute)

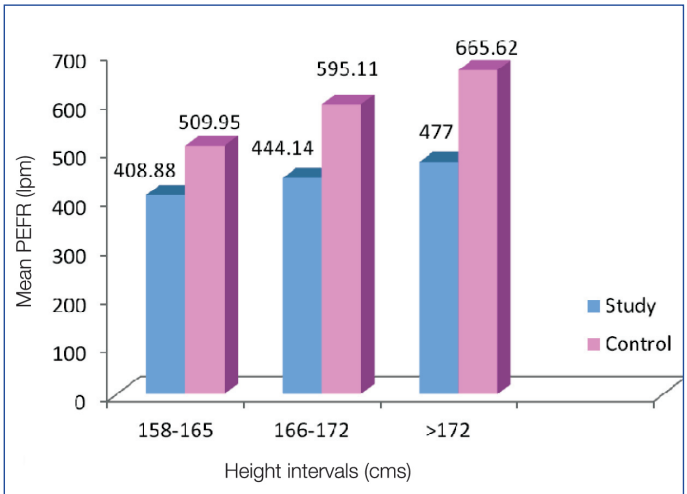
PEFR and Height: This study showed that there was an increase in the PEFR of the study subjects with an increase in height. These results were co-related with those of a study which was done by Dikshit et al. 2005 [8]. When the mean PEFR of the study subjects was compared with that of the control subjects according to the three height intervals, the mean PEFR of the study subjects was found to be less than that of the control subjects in each interval and the results were found to be statistically highly significant. [Table/Fig-5] and [Table/Fig-6].

PEFR and Weight: This study showed that there was an increase in the PEFR of the study subjects with an increase in weight till the weight of 78 kg, after which there was a slight decline in the PEFR value. The results were in accordance with those of a study which was done by Singh and Peri [9]. When the mean PEFR of the study subjects was compared with that of the control subjects according to the three weight groups, the mean PEFR of the study subjects was found to be less than that of the control subjects in each group and the results were found to be statistically highly significant. [Table/Fig-7] and [Table/Fig-8].

Height intervals (in cms.)	Study		Control		't' value	'p' value	s
	No. of sub.	Mean ± SD of PEFR (in litres/min.)	No. of sub.	Mean ± SD of PEFR (in litres/min.)			
158-165	25	408.88±39.49	20	509.95±57.58	-6.69	< 0.005	HS
166-172	49	444.14±38.95	46	595.11±34.40	-20.05	< 0.005	HS
≥173	26	477±44.16	34	665.62±42.56	-16.65	< 0.005	HS

[Table/Fig-5]: Comparison of Mean and SD of PEFR in Study and control subjects according to height intervals

PEFR and Body Surface Area: This showed that there was an increase in the PEFR of the study subjects with an increase in the body surface area. The results were co-related with those of a study which was done by Sherif et al.1989 [10]. When the mean PEFR of the study subjects was compared with that of the control subjects according to the three body surface area groups, the mean PEFR of the study subjects was found to be less than that of the control subjects in each group and the results were found to be statistically highly significant. [Table/Fig-9] and [Table/Fig-10].



[Table/Fig-6]: Bar diagram showing comparison of Mean PEFR in study and control subjects according to height groups (lpm- litres per minute)

PEFR and the Duration of Exposure: The present study revealed that the mean PEFR in the study subjects had decreased with an increase in the duration of exposure to the pollutants. The results were similar to those of a study which was done by Chattopadhyay et al. 2003 [11]. Statistically highly significant differences are seen on comparing group I with group II ($t = 6.72$) ($p < 0.005$), group I with group III ($t = 9.41$) ($p < 0.005$), and group II with group III ($t = 4.94$) ($p < 0.005$) [Table/Fig-11] and [Table/Fig-12].

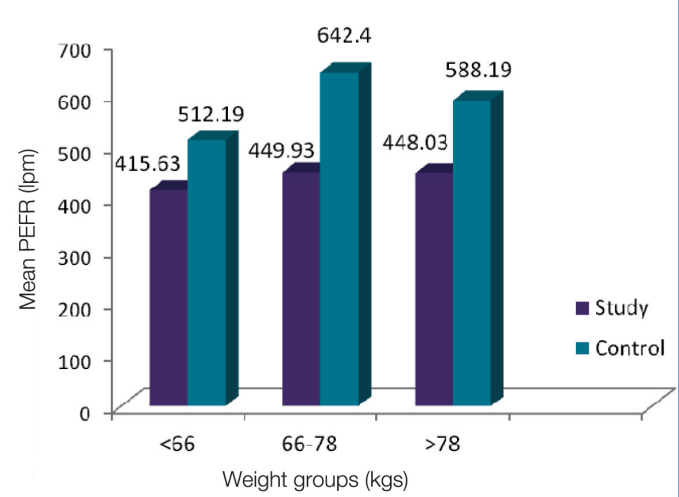
Our observation only gives information about a limited aspect of the pulmonary functions viz PEFR. A detailed assessment of the pulmonary functions including lung volumes and diffusion studies would provide a better insight into the suggested relationship.

CONCLUSION

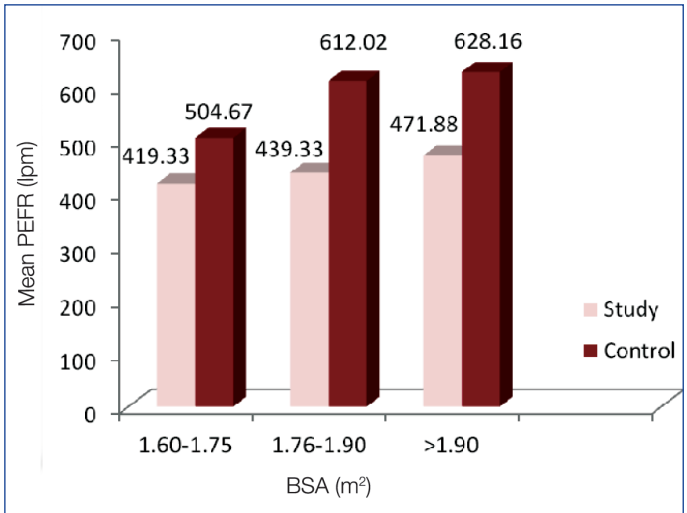
According to age, height, weight and body surface area which were divided in the different groups, the mean PEFR of the bus drivers was found to be less than that of the control subjects in each group and the results were found to be statistically highly significant. This decrease of the PEFR in the bus drivers was probably due to their

Weight groups (in kgs.)	Study		Control		't' value	'p' value	s
	No. of sub.	Mean ± SD of PEFR (in litres/min.)	No. of sub.	Mean ± SD of PEFR (in litres/min.)			
≤65	16	415.63±40.41	16	512.19±66.14	-4.98	<0.005	HS
66 – 78	54	449.93±39.77	48	642.40±46.82	-22.23	<0.005	HS
≥79	30	448.03±57.11	36	588.19±54.08	-10.16	< 0.005	HS

[Table/Fig-7]: Comparison of Mean and SD of PEFR in study and control subjects according to weight groups



[Table/Fig-8]: Bar diagram showing comparison of Mean PEFR in study and control subjects according to weight groups (lpm- litres per minute)



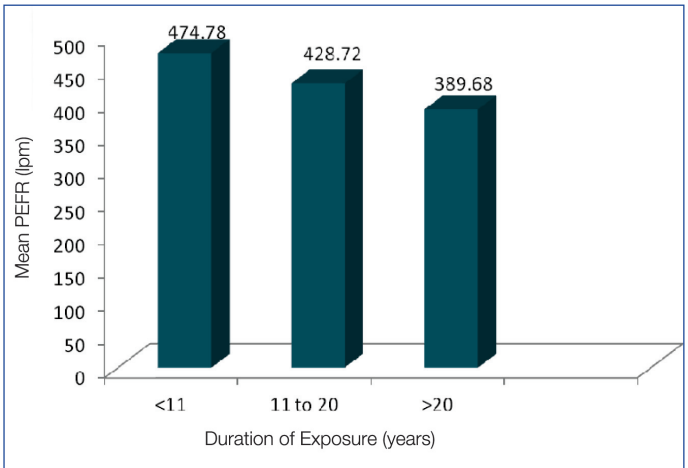
[Table/Fig-10]: Bar diagram showing comparison of Mean PEFR in study and control subjects according to body surface area groups (lpm- litres per minute)

BSA Groups (in m²)	Study		Control		't' value	'p' value	s
	No. of sub.	Mean ± SD of PEFR (in litres/min.)	No. of sub.	Mean ± SD of PEFR (in litres/min.)			
1.60-1.75	18	419.33±39.58	15	504.67±60.96	-4.66	< 0.005	HS
1.76-1.90	57	439.33±41.14	47	612.02±53.38	-18.17	< 0.005	HS
>1.90	25	471.88±52.07	38	628.16±59.12	-11.03	< 0.005	HS

[Table/Fig-9]: Comparison of Mean and SD of PEFR in study and control subjects according to body surface area

Group No.	DOE (in years)	No. of subjects	Range of PEFR (in litres/min.)	Mean±SD of PEFR (in litres/min.)
I	≤10	49	390–570	474.78±40.32
II	11 – 20	32	400–470	428.72±20.96
III	≥21	19	300–422	389.68±30.35

[Table/Fig-11]: Comparison of Mean and SD of PEFR in study subjects according to duration of exposure groups



[Table/Fig-12]: Bar diagram showing comparison of Mean PEFR in study and control subjects according to duration of exposure groups (lpm-litres per minute)

continuous occupational exposure to pollutants, which may have caused an adverse effect on their respiratory functions. There are many ways to reduce and prevent the ill effects of the pollutant exposure that is likely to occur at workplaces- regular respiratory checkups, regular check up of the buses and the use of air conditioned buses and personal protective equipment.

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FINANCIAL OR OTHER COMPETING INTERESTS:
None.

Date Of Submission: **Sep 11, 2011**
Date Of Peer Review: **Jan 06, 2012**
Date Of Acceptance: **Jan 13, 2012**
Date Of Publishing: **Apr 15, 2012**